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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B. Sc MICROBIOLOGY (CBCS STRUCTURE)
IV SEMESTER (2 HPW-2Credits) (2025 onwards)
SE431 B: INTERACTIONS WITH ENTREPRENEURS IN MICROBIAL TECHNOLOGY AND STARTUPS

Overall Course Objective:
Facilitate students to develop entrepreneurial skills in the field of microbial biotechnology

Submission of a project report by students after interaction with industry experts/enterprises/ Start-up companies in the field of Microbial Technology. The report must include novel ideas, innovations in production, development and commercialization of microbial products.

COURSE OUTCOMES:
By the conclusion of this course, the students

SE 431B. CO1. Understand the potential for commercialization in the field of Microbial Technology.
SE 431B. CO2. Design strategies for initiating microbial product based startup and development of commercial enterprise.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
B.Sc. MICROBIOLOGY
B.Sc. III YEAR SYLLABUS (2025 onwards)
SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
MB531 Paper MOLECULAR BIOLOGY & MICROBIAL GENETICS

Overall course objective:
To discuss DNA replication, transcription, translation and recombinant DNA technology

Unit Wise Course Objectives:

COb1: Describe the structure of DNA and explain mechanisms of DNA replication, transcription and translation
COb2: Categorise types of mutagens and summarize DNA repair mechanisms
COb3: Discuss gene expression and regulation
COb4: Explain various steps involved in recombinant DNA technology

UNIT-1: MICROBIAL GENETICS	**15hr**
DNA and RNA as genetic material	4hr
Structure of DNA –Watson and Crick model	2hr
Extra chromosomal genetic elements- Plasmids and Transposons	4hr
Replication of DNA-Semi conservative mechanism	5hr

UNIT-2: MUTATIONS AND GENETIC RECOMBINATION	**15hr**
Mutations-Spontaneous and induced	2hr
Base pair changes, Frameshift, Deletion, Inversion, Tandem duplication, Insertion	3hr
Various physical and chemical mutagens	4hr
Outline of DNA damage and repair mechanism	3hr
Brief account on gene transfer among bacteria –Transformation, Transduction and Conjugation	3hr

UNIT-3-GENE EXPRESSION	**15hr**
Concept of gene – Muton, Recon and Cistron	2hr
One gene-one enzyme, One gene-one Polypeptide, One gene-one product Hypothesis.	1hr
Types of RNA and their functions	2hr
Outline of RNA transcription in Prokaryotes	3hr
Genetic code, Structure of Ribosomes and brief account on Protein synthesis	2hr
Type of genes –Structural, Constitutive, Regulatory	2hr
Operon concept. Regulation of gene expression in bacteria –Lac Operon.	3hr

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UNIT-4-RECOMBINANT DNA TECHNOLOGY **15hr**

Basic principles of genetic engineering- Restriction endo-nucleases, DNA polymerases and Ligases, Vectors	4hr
Outline of gene cloning methods. Genomic and cDNA libraries	5hr
General account on application of genetic engineering in industry, agriculture and medicine	4hr
Introduction to concept of Genome editing- CRISPR-Cas	2hr

References:

1. Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, NewDelhi.
2. Crueger,W. and Crueger,A.(2000).Biotechnology:ATextBookofIndustrialMicrobiology, Prentice-Hall of India Pvt.Ltd., New Delhi.
3. Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press,Washington D.C., USA.
4. Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
5. Strickberger, M.W.(1967). Genetics. Oxford & IBH, New Delhi.
6. Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). Principles of Genetics. 5th Edition. McGraw Hill, New York.
7. Glazer,A.N. and Nikaido,H.(1995).Microbial Biotechnology–Fundamentals of Applied Microbiology, W.H. Freeman and company, New York.
8. Old, R.W. and Primrose, S.B. (1994) Principles of Gene Manipulation, BlackwellScience Publication, New York.
9. Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology,Evolution and Ecology.S. Chand& Co. Ltd., New Delhi.

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V SEMESTER PRACTICALS (2 HPW-1Credit)
MB531 P Paper V Molecular Biology and Microbial Genetics (2HPW-Credits-1)

1. Colorimetric estimation of proteins by Biuret method.
2. Colorimetric estimation of DNA by Diphenyl amine method.
3. Colorimetric estimation of RNA by Orcinol method.
4. Extraction of genomic DNA
5. Extraction of plasmid DNA
6. Separation and observation of genomic DNA by Agarose gel Electrophoresis
7. Separation and observation of plasmid DNA by Agarose gel Electrophoresis

References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.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.
5. Mahy,B.W.J. and Kangro, H.O. Virology –Methods Manual Academic Press, USA.
6. Burleson etal Virology– A Laboratory Manual. AcademicPress,USA.

Course Outcomes:

At the end of the course student will be able to

MB531.CO1: Summarize the mechanisms of replication, transcription and translation
MB531.CO2: Prepare a mind map of types of mutagens and their mechanism of action
MB531.CO3: Extract DNA from bacteria and estimate molecular weight of isolated DNA
MB531.CO4: Prepare a pictorial representation of various steps involved in Recombinant DNA technology and present applications of Recombinant DNA technology in various fields

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
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B.Sc. III YEAR SYLLABUS (2025 onwards)
SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
MB531 A Paper MICROBIAL OMICS

Overall course objective:
To know the basics of omics, proteomics, genomics and bioinformatics

Unit Wise Course Objectives:

COb1: Understand the concept of omics.
COb2: Explain the methods of proteomics.
COb3: Learn the techniques in genomics.
COb4: Outline the basics of bioinformatics.

UNIT1: INTRODUCTION TO OMICS **15hr**

Introduction to molecular biology. Structure of DNA, RNA. 3hr
Multiomics approach for analysis of Microbial biology: 5hr
Genomics, Transcriptomics (RNA-Seq), Proteomics, Metabolomics,
Metagenomics and their applications. 2hr
Basic Concepts in high throughput sequencing or Next-Generation Sequencing methods
for use in food-microbiology, diagnostics and Human health. 5hr

UNIT2: PROTEOMICS **15hr**

Protein structure – Different levels of protein structure,
Protein Folding and unfolding. 4hr
Protein secondary and 3D structure prediction methods. 3hr
X-ray crystallography, NMR and homology modeling. 3hr
Protein microarrays-Protein Markers, Clinical Proteomics,
Protein engineering, Proteomic strategies in Cancer, Prions. 5hr

UNIT3: GENOMICS **15hr**

An introduction of functional genomics; Site-directed mutagenesis,
Transposon mutagenesis, DNA microarray, RNA interference, and
Chromatin immune precipitation. 6hr
Genome annotation, Applications of functional genomics in vaccine
And drug designing. 4hr
Genome editing tools such as CRISPR/Cas9. 2hr
Databases of Microbial Genomics; Microbial genome projects 3hr

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UNIT 4: BIOINFORMATICS **15hr**

Introduction to Bioinformatics and Molecular Databases,	1hr
Primary Databanks – NCBI, EMBL, DDBJ;	2hr
Secondary Databases – UNIPROT;	1hr
Structural Database –PDB; Database similarity search (FASTA, BLAST)	2hr
Alignment: Pairwise and Multiple sequence alignment;	2hr
Whole genome sequence; Genome Annotation and Gene Prediction;	4hr
Primer Designing; Phylogenetic analysis and Tree construction.	3hr

References:

1. Principles of Protein structure, Schultz, G. E., and Schirmer, R. H.Dr. ShaktiSahi
2. Proteomics, Daniel C. Leibler
3. Microbial Proteomic, MarjoPoutanen
4. Proteins: Structures and Molecular Principles (2d ed.), TE Creighton
5. Organic spectroscopy, William Kemp
6. Proteome Research: Two-Dimensional Gel Electrophoresis and Detection Methods (Principles and Practice), T. Rabilloud (Editor), 2000, Springer Verlag
7. Introduction to Protein Architecture: The Structural Biology of Proteins, M.Lesk, 2001, Oxford University Press.
8. Molecular Biotechnology by Bernard R. Glick and Jack J Pasternak
9. DNA Microarrays Ed. M. Schena.

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V SEMESTER PRACTICALS (2 HPW-1Credit)
MB531A P Paper V Microbial Omics (2 HPW-Credits-1)

1. Protein isolation from *E.coli.*
2. Sequence analysis of proteins (by BLAST, ClustalW and Phylip).
3. Protein structure prediction by Homology modeling.
4. Isolation of Genomic DNA from *E.coli* and its demonstration by OD and Agarose electrophoresis.
5. Isolation of plasmid DNA from *E.coli* and its demonstration by OD and Agarose electrophoresis.
6. DNA molecular size determination.
7. Primer designing using online software.
8. PCR amplification of genes and detection of amplicon by Agarose gel electrophoresis.

References:

1. Molecular biotechnology by Chanarayppa
2. Methods in Molecular Cloning by Sambrook.
3. Gopal Reddy, M., Reddy, M.N., SaiGopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.

Course Outcomes:
At the end of the course student will be able to

MB531A. CO1: Discuss the concept of omics.
MB531A. CO2: List the methods to study proteomics.
MB531A. CO3: Outline the methods in genomics.
MB531A. CO4: Execute the applications of bioinformatics.

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B.Sc. III YEAR SYLLABUS (2025 onwards)
SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
GE 531 MICROBIOLOGY AND HUMAN HEALTH

Overall course objective:
To explain the relevance of microorganisms in daily life

Unit Wise Course Objectives:

GE 531.COb1: Overview on history of microbiology, cultivation and staining of microbes.
GE 531.COb2: Study of various infectious diseases.
GE 531.COb3: Learn the significance of immune system.
GE 531.COb4: Understand the safe disposal of industrial and Biomedical waste.

UNIT-1: INTRODUCTION	**15hr**
Historic developments of Microbiology	1hr
Contributions of Van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch.	4hr
Types of microorganisms	2hr
Morphological characteristics of bacteria, staining	3hr
Cultivation methods of bacteria, Culture Media used for the growth of microorganisms.	4hr

UNIT-2: MICROORGANISMS: GOOD AND BAD	**15hr**
Microorganisms related to human health.	1hr
Normal microbial flora, Human microbiome concept.	4hr
Bacterial disease: Typhoid, Tuberculosis, Syphilis Viral diseases: Flu, MERS, SARS, CoV-2, HIV Insect borne: Malaria and Dengue	10hr

UNIT-3: IMMUNITY AND HEALTH	**15hr**
Introduction to immune system	1hr
Understanding the terms: Disease, Infection, Pathogenicity, Prophylaxis, Host resistance.	4hr
Innate immunity and Acquired immunity.	4hr
Epidemics, Endemics and Pandemics.	1hr
Importance of probiotics and vaccines for human health.	5hr

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UNIT-4: WASTE MANAGEMENT AND HEALTH HAZARDS **15hr**

Health hazards associated with dumpage of Industrial and Biomedical waste.	3hr
National and international guidelines for the disposal of waste.	1hr
Guidelines of Central Pollution Control Board (CPCB).	1hr
Safe disposal and pretreatment of wastes.	5hr
Mechanical and chemical treatment of the waste. Autoclaving, incineration.	5hr

References:

1. Michael J.Pelczar,Jr. E.C.S. Chan, NoelR.Krieg Microbiology Tata Mc Graw-Hill Publisher.
2. Prescott,M.J., Harly,J.P. and Klein Microbiology 5th Edition,WCB Mc GrawHill, NewYork.
3. Madigan,M.T., Martinkl,J.MandParker, j.BrochBiologyofMicroorganism,9thEdition,MacMillan Press, England.
4. Dube,R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.
5. Ananthanarayanand Panikar. Text book of Microbiology. Universities Press.

Course Outcomes:

At the end of the course student will be able to

GE 531. CO1: Learn the outlines of history and techniques in microbiology.
GE 531. CO2: Classify the beneficial and non-beneficial microbes.
GE 531. CO3: Acquire the knowledge on immunity and health.
GE 531. CO4: Summarize on the methods on waste management.

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SUBJECT -MICROBIOLOGY
VI SEMESTER (4 HPW-4Credits)
MB631 INDUSTRIAL MICROBIOLOGY

Overall course objective:
To discuss industrially important microbes and its products

Unit Wise Course Objectives:

COb1: Describe the methods for Bioprospecting industrially important microbes.
COb2: Provide outlines of design of fermentor and optimization of fermentation conditions.
COb3: Elaborate various types of fermentations.
COb4: Discuss various microbial products.

UNIT-1: MICROORGANISMS AND SELECTION	**15hr**
Introduction to Industrial Microbiology	2hr
Microorganisms of industrial importance-Yeast, Molds, Bacteria, Actinomycetes.	2hr
Screening and selection of industrially useful microbes.	4hr
Steps to maintain seed culture and inoculation strategies for enhanced product yield.	3hr
Strain improvement strategies.	2hr
Immobilization methods – Adsorption and Entrapment.	2hr

UNIT-2: FERMENTATION	**15hr**
Bioreactor, Design of a Fermentor-Fermentation equipment and its use. Agitation, Aeration, Antifoam, pH and Temperature control.	6hr
Types of fermentors	3hr
Stages of fermentation process- Upstream and Downstream processing.	1hr
Raw materials used in fermentation industry and their processing Inoculation media and fermentation media	5hr

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UNIT-3: TYPES OF FERMENTATON **15hr**

Types of fermentations: Batch, Fed batch, continuous types	4hr
Submerged, Surface, Solid state, Dual and Multiple fermentations	4hr
Advantages and disadvantages of Solid substrate and Liquid fermentations.	3hr
Common Microbial fermentation- Alcohol and Lactic acid fermentation.	4hr

UNIT-4: MICROBIAL PRODUCTS **15hr**

Industrial products derived from microbes: Vitamin-B12	3hr
Vaccines: Recombinant vaccines (Hepatitis B)	2hr
Production of alcoholic beverages (Ethanol and Beer)	3hr
Biofuels (Biogas) Enzymes (Amylase), Antibiotics (Penicillin), Amino acids (Glutamicacid), Organic acid (Citric acid).	6hr
Disposal of industrial waste.	1hr

References:

1. Patel, A.H.(1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad.
2. Cassida,L.E.(1968).IndustrialMicrobiology,WileyEasternLtd.&NewAgeInter national Ltd., New Delhi.
3. Crueger,W.andCrueger,A.(2000).Biotechnology–ATextBookofIndustrialMicrobiology, Panima Publishing Corporation, New Delhi
4. Reedy, G. (Ed.) (1987). Prescott & Dunn's Industrial Microbiology, 4th Edition, CBS Publishers & Distributors,New Delhi.
5. Reddy,S.R. and SingaraCharya,M.A.(2007).ATextBookofMicrobiology-AppliedMicrobiology.Himalaya Publishing House, Mumbai.
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VI SEMESTER PRACTICALS (2 HPW-1Credit)

MB631 P Paper V Industrial Microbiology (2 HPW-Credits-1)

1. Screening for amylase producing microorganisms.
2. Screening for organic acid producing microorganisms.
3. Estimation of Ethanol by potassium dichromate method.
4. Production of Citric acid by submerged fermentation.
5. Estimation of Citric acid by titrimetric method.
6. Microbial production of Penicillin.
7. Bacterial slides-*Bacillus, Lactobacillus, Yeast, Aspergillus, Penicillium.*

References:

1. Patel, A.H.(1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad.
2. Cassida,L.E.(1968).IndustrialMicrobiology,WileyEasternLtd.&NewAgeI nternational Ltd., New Delhi.
3. Crueger,W.andCrueger,A.(2000).Biotechnology–TextBookofIndustrialMicrobiology, Panima Publishing Corporation, NewDelhi
4. Reedy, G. (Ed.) (1987). Prescott & Dunn's Industrial Microbiology, 4th Edition, CBSPublishers & Distributors,New Delhi.
5. Reddy,S.R.and SingaraCharya,M.A. (2007). A Text Book of Microbiology AppliedMicrobiology.Himalaya Publishing House, Mumbai.
6. Singh,R.P. (2007). Applied Microbiology. Kalyani Publishers, New Delhi.
7. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology andBiotechnology, ASMPress, Washington, D.C., USA.

Course Outcomes:

At the end of the course student will be able to

MB631. CO1: Isolate microbes producing industrially important compounds.
MB631. CO2: Elucidate steps of various microbial fermentation procedures.
MB631. CO3: List the various types of fermentations.
MB631. CO4: Explain the production of various microbial products.

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SUBJECT - MICROBIOLOGY
VI SEMESTER (4 HPW-4Credits)
MB631 A Paper PHARMACEUTICAL MICROBIOLOGY

Overall course objective:
To elaborate on various chemotherapeutic agents, their mode of action, genetics of resistance development in microbes and methods to determine antibiotic sensitivity.

Unit Wise Course Objectives:

COb1: Discuss the concepts of chemotherapy and anti-microbial agents.
COb2: Present the concept of antibiotics and its uses.
COb3: Elaborate various types of fermentations.
COb4: Review the methods in microbiological assays.

UNIT-1: INTRODUCTION TO CHEMOTHERAPY	**15hr**
History of chemotherapy–Plants and arsenicals as therapeutics	3hr
Paul Ehrlich and his contributions	3hr
Selective toxicity and target sites of drug action in microbes.	4hr
Development of synthetic drugs–Sulphanamides, antitubercular compounds, nitrofurans, nalidixicacid, metronidazole group of drugs.	5hr

UNIT-2: ANTIBIOTICS	**15hr**
The origin, development and definition of antibiotics as drugs	2hr
Types of antibiotics and their classification.	3hr
Non-medical uses of antibiotics.	2hr
Principles of chemotherapy – Clinical and lab diagnosis, sensitivity testing, choice of drug, dosage, route of administration, combined/ mixed multi drug therapy, control of antibiotic/drug usage.	8hr

UNIT-3: DRUG RESISTANCE	**15hr**
The phenomenon of drug resistance, Clinical basis of drug resistance, Biochemistry of drug resistance, Genetics of drug resistance in bacteria.	6hr
Mode of action of important drugs –Cell wall inhibitors (Beta lactam – e.g., Penicillin),	2hr
Membrane inhibitors (Polymyxins), macromolecular synthesis inhibitors (Streptomycin)	5hr
Antifungal antibiotics (Nystatin)	2hr

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UNIT-4: MICROBIOLOGICAL ASSAYS **15hr**

Assays for growth promoting substances, nutritional mutants and their importance. 5hr

Drug sensitivity testing methods and their importance. 4hr

Assay for antibiotics – Determination of MIC, the liquid tube assay, Solid agar tube assay, Agar plate assay (disc diffusion, agar well and cylinders cup method). 6hr

References:

1. Ananthanarayan, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6thEdition, Oriental Longman Publications, USA.
2. Gupte,S.(1995).ShortTextBookofMedicalMicrobiology,8thEdition,J aypeeBrothers MedicalPublishers(P)Ltd, New Delhi.
3. Biochemistry of antimicrobial action. Franklin, DJ. And Snow, GA.Pub:Chapman&Hall. Antibiotics and Chemotherapy. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Publ:Churchill Livingstone.
4. Antibiotics.Lancini, G. and Parenti, F.publ: Springer-Verlag. The Molecular Basis of antibiotic action.Ga. e, EF. Etal. Publ: Wiley, New York.Antimicrobial Drug action.Williams, RAD., Lambart, PA.& Singleton, P. Pub:BiosSci.MicrobiologicalAssays.Hewitt.

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VI SEMESTER PRACTICALS

MB631A P Paper VI Pharmaceutical Microbiology (2 HPW-Credits-1)

1. Tests for disinfectants (Phenol coefficient/RWC).
2. Determination of antibacterial spectrum of drugs/antibiotics.
3. Chemical assays for antimicrobial drugs.
4. Testing for antibiotic/drug sensitivity/resistance.
5. Determination of MIC for antimicrobial compounds.
6. Microbiological assays for antibiotics (Liquid tube assay, Agar tube assay, Agar plate assays).

References:

1. Disinfection, sterilization and preservation. Block, S.S. (ed).Lea and Febigor, Baltimore
2. Pharmaceutical Microbiology. Huge, W.B. and Russel, AD. Blackwell Scientific, Oxford
3. Inhibition and destruction of microbial cell by Hugo, WB. (ed). Pub: Academic Press, NY
4. Manual of Clinical Microbiology. Lennette, EH. (ed). Pub: American Society for Microbiology, Washington.
5. Principles and Practices of disinfection.Russell, AP., Hugo,WB., and Ayliffe, GAJ. (eds).Publ. Blackwell Sci.
6. Biochemistry of antimicrobial action. Franklin, DJ. And Snow, GA. Pub: Chapman& Hall.
7. Antibiotics and Chemotherapy. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Publ: Churchill Livingstone.
8. The Molecular Basis of antibiotic action. Ga. e, EF. Et al. Publ: Wiley, New York.
9. Antimicrobial Drug action. Williams, RAD., Lambart, PA. & Singleton, P. Pub: Bios Sci.

Course Outcomes:

At the end of the course student will be able to

MB631A. CO1: Discriminate the mode of action of various antimicrobial agents.
MB631A.CO2: Apply practical skills and determine the antimicrobial spectrum of antibiotics.
MB631A.CO3: Test the microbial drug resistance.
MB631A.CO4: Perform microbiological assays in pharmaceutical industry.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
B.Sc. MICROBIOLOGY
B.Sc. III YEAR SYLLABUS (2025 onwards)
SUBJECT - MICROBIOLOGY
VI SEMESTER (4 HPW-4 Credits)

MB 631_O APPLIED MICROBIOLOGY AND ARTIFICIAL INTELLIGENCE

Overall course objective:

To discuss commercial applications of microbial products, artificial intelligence in biology and medicine, intellectual property rights and patenting procedures.

Unit Wise Course Objectives:

COb1: Discussion of various commercially important microbes and their multiplication methods for application in agriculture.
COb2: Understand the utility of metabolic engineering for production of microbial products.
COb3: Outline the concept of artificial intelligence for its application in biology and medicine.
COb4: Provide insights on IPR, types of patents and its filing procedures.

UNIT-I: Microbial Products for Small Scale Entrepreneurs	**15hr**
Maintenance of type strains or reference strain of microorganisms: Culture collection centres (ATCC, MTCC)	2hr
Microorganisms in agriculture. Nitrogen fixers and Phosphate solubilizers.	3hr
Biofertilizers-Production of *Azolla*, *Rhizobium* and *Mycorrhizae*.	3hr
Bio fungicides- Mass production of *Trichoderma* and *Pseudomonas*	
Biopesticides-Bacterial- *Bacillus thuringenesis* BT, Fungal- *Trichoderma* and Viral- Nuclear Polyhedrosis Virus NPV	3hr 4hr

UNIT-2: Metabolic Engineering for Microbial Products	**15hr**
Production of microbial pigments (Prodigiosin, Violacein, Monascin).	3hr
Bacterial and Algal carotenoids	2hr
Microorganisms for flavour and aroma production.	4hr
Biotransformation and metabolic engineering of microorganisms to produce compounds such as esters, terpenes, aldehydes, lactones, geosmin, vanillin, coumarin.	6hr

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UNIT-3: Applications of Artificial Intelligence (AI) in Biology **15hr**

Basic concepts, terminologies and workflow of AI	2hr
Role of AI in pharmaceutical industry for improvement of drug designing and medicine	3hr
AI in health diagnostics for monitoring health and disease	3hr
Importance of AI in transforming agriculture	3hr
Future prospects of AI in healthcare and research, risks involved and ethical concerns in its application	4hr

UNIT- 4: Intellectual Property Rights and Patenting **15hr**

Introduction to intellectual property rights	2hr
Patents, types, trademarks, copyrights, industrial designs and traditional knowledge	6hr
Legal protection of biotechnological inventions, world intellectual property rights	3hr
Grant of patent and patenting authorities, Introduction to patent filing procedures, Indian patent act 1970 and recent amendments	4hr

References:

1. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) Ltd.New Delhi.
2. Rangaswami, G. and Bhagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Edition, Prentice Hall of India, New Delhi.
3. Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications, Addison Wesley Longman,lnc., USA.
4. Dr Parag Suresh Mahajan (2019). Artificial intelligence in healthcare, 2nd Edition.
5. R.C.Dubey and D.K.Maheswari (2010). A textbook of Microbiology. S. Chand & Co.,New Delhi.

Course Outcomes:

At the end of the course student will be able to

MB 631_O.CO1: List various microbial products and their commercial applications.
MB 631_O.CO2: Understand the process of producing microbial pigments and flavours.
MB 631_O.CO3: Evaluation of concept of AI to apply in biology, medicine, diagnostics.
MB 631_O.CO4: Acquaint with IPR and patent filing procedures.

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BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND COMMERCE, SAINIKPURI, SECUNDERABAD.
Autonomous College
Affiliated to OSMANIA UNIVERSITY,
Hyderabad.
(Reaccredited with 'A' grade by NAAC)
Department of Microbiology
(B.Sc. Life Sciences) Semester –VI CBCS
(2025 onwards)
PROJECT WORK

Credits: 4
Paper Code: T632_PW
No of Hours: 60 (4hr/wk)

1. Basic concepts of Project planning

   a) Selection of Project topic and defining objectives
   b) Planning of methods/approaches

2. Guidelines for Project writing

   - Title of the Project, Name of the Student & Supervisor
   - Declaration by the Student &Supervisor
   - Objectives of the project
   - Introduction & Review of Literature
   - Methodology
   - Results and Discussion
   - Conclusion
   - References

Course Objectives:
COb 1: To select a research topic and execute the planned work using correct methodology.

COb 2: To organize the completed work in the form of project dessertation and submit.

1. Project work will involve experimental work/data collection and it has to be completed in the stipulated time by the student.
2. Students will be asked their choice for Project work at the beginning of Semester VI and all formalities of topic and mentor selection will be completed. Project work will be offered as per the expertise and infrastructural facilities available in the department.
3. Project work may be allotted to students as individual or as group project (not exceeding5 students per group).
4. The completed work and compiled data would be presented in the form of results and submitted in the form of a dissertation/project report.

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5. Final evaluation of the project work will be through a panel consisting of internal and external examiners.
6. Guidelines provided for execution and evaluation of project work would be strictly adhered.
7. The grading would be based on evaluation of punctuality, experimental work, record keeping, academic inputs, data presentation, interpretation etc.

Course Outcome

At the end of the course, students will be able to

CO1: Plan and execute a project effectively in the stipulated time

CO2: Develop analytical skills, statistical data handling skills, paper writing and oral presentation skills.

PROJECT WORK EVALUATION SCHEME

Presentation of Thesis Dissertation to External Examiner	- 70 Marks
Continuous Evaluation by the Internal Examiner	- 30 Marks
Total	- 100 Marks

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