

B.Sc Academic year 2024-2027



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

Autonomous College (Affiliated to Osmania University)

(Accredited with "A" Grade by NAAC)

Department of Microbiology

Template for B Sc Microbiology under CBCS

(With effect from academic year 2024-27)

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
MB331 / 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. III YEAR SYLLABUS (2024 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

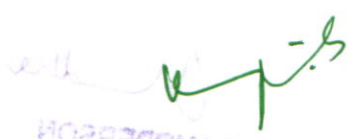
4hr

Introduction to concept of Genome editing- CRISPR-Cas

2hr

References:

1. Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
2. Crueger, W. and Crueger, A. (2000). Biotechnology: A Text Book of Industrial Microbiology, 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. Sinnott 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, Blackwell Science 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 (3 HPW-1Credit)
MB531 P Paper V Molecular Biology and Microbial Genetics (3HPW-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 et al Virology– A Laboratory Manual. AcademicPress,USA.

Course Outcomes:

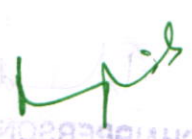
At the end of the course student will be able to

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 (2024 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

10hr

Viral diseases: Flu, MERS, SARS, CoV-2, HIV

Insect borne: Malaria and Dengue

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

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


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References:

1. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R. Krieg Microbiology Tata Mc Graw-Hill Publisher.
2. Prescott, M.J., Harley, J.P. and Klein Microbiology 5th Edition, WCB Mc Graw Hill, New York.
3. Madigan, M.T., Martinko, J. and Parker, J. Brock Biology of Microorganisms, 9th Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.
5. Ananthanarayan and 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

UNIT-3: TYPES OF FERMENTATION

15hr

Types of fermentations: Batch, Fed batch, continuous types

4hr

Submerged, Surface, Solid state, Dual and Multiple fermentations

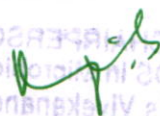
4hr

Advantages and disadvantages of Solid substrate and Liquid fermentations.

3hr

Common Microbial fermentation- Alcohol and Lactic acid fermentation.

4hr


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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 (Glutamic acid), 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). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
3. Crueger, W. and Crueger, A.(2000). Biotechnology – A Text Book of Industrial Microbiology, 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 Singara Charya, M.A.(2007). A Text Book of Microbiology- Applied Microbiology. Himalaya Publishing House, Mumbai.
6. Singh, R.P. (2007) Applied Microbiology. Kalyani Publishers, New Delhi


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VI SEMESTER PRACTICALS (3 HPW-1Credit)
MB631 P Paper V Industrial Microbiology (3HPW-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). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
3. Crueger, W. and Crueger, A. (2000). Biotechnology—Text Book of Industrial Microbiology, 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 Singara Charya, M.A. (2007). A Text Book of Microbiology Applied Microbiology. 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 and Biotechnology, ASM Press, 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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B.Sc. III YEAR SYLLABUS (2024 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 thuringensis* BT,

3hr

Fungal- *Trichoderma* and Viral- Nuclear Polyhedrosis Virus NPV

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, Inc., 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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Department of Microbiology

(B.Sc. Life Sciences) Semester –VI CBCS

W.e.f 2024-25 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 dissertation 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 exceeding 5 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.
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.

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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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