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 II YEAR SYLLABUS (2025 onwards)
SUBJECT-MICROBIOLOGY
III SEMESTER (4 HPW-4Credits)
MB331 Paper III Food and Environmental Microbiology

OVERALL COURSE OBJECTIVE:

Explain role of microbes in food industry, bioremediation and Sewage treatment methods.

UNIT WISE COURSE OBJECTIVES:

COb1. Discuss the significance of fermented foods and microbes as food
COb2. Elucidate the importance of food quality control.
COb3. Describe the role of microbes in the area of environmental pollution.
COb4. Explain the role of PGPR (Plant Growth promoting Microorganisms) and Bioremediation.

UNIT-1 Fermented Foods & Microbes as food	**15hrs**
Introduction to fermented foods	1hr
Health benefits of fermented foods	1hr
Concept of probiotics and prebiotics	2hr
Cereal based fermented foods- Idly & Bread	2hr
Fermented vegetables- processing and fermentation of Sauerkraut and Pickles	2hr
Microbes in milk and their significance	1hr
Fermented milk products- Yoghurt, Bulgarian milk, Kefir and Cheese	4hr
Microorganisms as food- Single cell protein, Edible mushrooms	2hr

UNIT-2 Microbial Food Spoilage and Quality Control	**15 hrs**
Microbial spoilage of milk, meat, fruits and canned foods	3hr
Microbial food Poisoning, risks & hazards	2hr
Mycotoxins and their toxicity	1hr
Food preservation methods and food safety issues	4hr
Food quality- importance and functions of quality control	2hr
Microbiological analysis of food-Screening, enumeration and detection of pathogens.	3hr

UNIT-3 Air and Water Microbiology	**15 hrs**
Microorganisms in air and their importance- A brief account	3hr
Microorganisms in water pollution- waterborne pathogenic microorganisms and their transmission	3hr
Sanitary quality of water- Coliform test, MPN	3hr
Water pollution due to degradation of organic matter- Aerobic and Anaerobic sewage treatment.	6hr

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UNIT - 4 Soil Microbiology **15 hrs**

Soil properties - Physical, chemical and biological	2hr
Soil microorganisms- methods of enumeration and activity of microbes in soil	3hr
Microbes and plant interactions- Rhizosphere, Phyllosphere, Mycorrhizae	3hr
Introduction to microbial bioremediation- microbial degradation of organic pollutants	3hr
Biogeochemical cycles- Carbon cycle, Nitrogen cycle	4hr

TEXT AND REFERENCE BOOKS

1. Casida. L. E. Industrial Microbiology (1999).10th edition. New Age International Publication, NewDelhi.
2. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, AdityaBooks (P) Ltd. New Delhi.
3. Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). Food Microbiology: Fundamentals andFrontiers. ASM Press, Washington D.C., USA.
4. Frazier, W.C. and Westhoff, D.C. (1988). Food Microbiology, McGraw-Hill, New York.
5. Jay, J.M. (1996). Modern Food Microbiology, Chapman and Hall, New York.
6. Ray, B. (1996). Fundamentals of Food Microbiology, CRC Press, USA.
7. Adams, M.R. and Moss, M.O. (1996). Food Microbiology, New Age International (P) Ltd, NewDelhi.
8. Paul, E.A. and Clark, F.E. (1989). Soil Microbiology and Biochemistry, Academic Press, USA.
9. Lynch, J.M. and Poole, N.J. (1979). Microbial Ecology - A Conceptual Approach, BlackwellScientific Publications, USA
10. Alexander Martin. Soil Microbiology (2001).
11. Reddy, M.N., Uma Maheshwara Rao., Naga Padma, P., Raghuram, M, Charitha Devi, M. (2012) Applied Microbiology, Telugu Akademy.

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III SEMESTER PRACTICALS (2 HPW-1Credit)
MB331 P Paper III Food and Environmental Microbiology

1. Isolation and identification of probiotic bacteria and yeast
2. Determination of microbiological quality of milk by MBRT method
3. Preparation of fermented foods: Yoghurt, Sauerkraut
4. Microbiological analysis of food- Isolation, Enumeration & Detection of pathogens
5. Extraction of mycotoxins from contaminated grains/ food
6. Detection of Mycotoxins
7. Isolation of microorganisms from air by impingement method
8. Microbiological examination of water by Coliform test
9. Determination of biological oxygen demand
10. Isolation & Enumeration of microbes from Rhizosphere and Phyllosphere

References

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
2. Reddy, S.M. and Reddy, S.R. (1998). Microbiology- Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad
3. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
4. Gupte, S. (1995). Practical Microbiology. Jaypee Brothers Medical Publishers Pvt. Ltd.

COURSE OUTCOMES:

The Student will be able to

MB331.CO1. Understand the process fermented food production
MB331.CO2. Analyze the microbiological quality of food samples
MB331.CO3. Evaluate the sanitary quality of air and water.
MB331.CO4. Summarize the role of microbes in plant growth and bioremediation

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC II YEAR SYLLABUS (2025 onwards)
SUBJECT-MICROBIOLOGY
III SEMESTER (2 HPW-2Credits)

SE331 A: MUSHROOM CULTIVATION

OVERALL COURSE OBJECTIVE:

To provide theoretical and practical details of mushroom cultivation.

COURSE OBJECTIVES:

COb1. Explain mushroom cultivation method
COb2. Outline methods of mushrooms preservation

Unit-1 **15 hrs**

Introduction to mushroom cultivation. Importance and history of mushroom cultivation in India.
Global status of mushroom production.
Food value of mushroom.

Unit-2 **15 hrs**

Steps in mushroom cultivation

- Selection of site and types of mushroom
- Mushroom farm structure, design layout
- Principle and techniques of compost and composting
- Principle of spawn production
- Casing and crop production
- Harvesting and marketing
- Pest and pathogens of mushrooms
- Post-harvest handling and preservation of mushrooms

REFERENCES:

1. Mushroom cultivation in India by B.C. Suman and V.P. Sharma. Published by Daya Publishing House, New Delhi.
2. Mushrooms Cultivation, Marketing and Consumption by Manjit Singh Bhuvnesh Vijay Shwet Kamal G.C. Wakchaure Directorate of Mushroom Research (Indian Council of Agricultural Research) Chambaghat, Solan -173213 (HP)

COURSE OUTCOMES:

SE 331A. CO1. Summarize mushroom cultivation in methods.
SE 331A. CO2. Tabulate the nutritional value of mushrooms

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III SEMESTER (2 HPW-2Credits)

SE331 B: MICROBIAL PRODUCTS - BIO-FERTILIZER & BIO-PESTICIDES

(2025 onwards)

OVERALL COURSE OBJECTIVE:

To provide theoretical and practical details of various Biofertilizers and Biopesticides.

COURSE OBJECTIVES:

COb1. Explain about various Biofertilizers
COb2. Outline methods of production of Biofertilizers and Biopesticides

UNIT-1 **15 hrs**

Biofertilizers: General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.

Symbiotic N2 fixers: Rhizobium - Isolation, characteristics, inoculum production and field application.

Cyanobacteria as bio-fertilizers- Isolation, characterization, mass multiplication, mass inoculums production and field application

A brief account on Phosphate Solubilizers and Mycorrhizal Bio-fertilizers

UNIT-2 **15 hrs**

Bioinsecticides: General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, Bacillus thuringiensis, production, Field applications, Viruses - cultivation and field applications.

REFERENCES

1. Eldor A. Paul. Soil Microbiology. Ecology and Biochemistry. VI Edition: Academic Press, (2007).
2. Eugene L. Madsen. Environmental Microbiology: From Genomes to Biogeochemistry. Edition, Wiley Blackwell Publishing. (2008).
3. Agrios, G. N. Plant pathology. Harcourt Asia Pvt. Ltd. (2000).
4. Shalini Suri. Biofertilizer and Biopesticide Aph Publishing Corporation (2011)

COURSE OUTCOMES

SE 331B. CO1. Students will develop a very good understanding of practical aspects of production of Biofertilizers.
SE 331B. CO2. Students will develop a very good understanding of practical aspects of the production of Biopesticides/bioinsecticides

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B. Sc II YEAR SYLLABUS (2025 onwards)
SUBJECT-MICROBIOLOGY
IV SEMESTER (4 HPW-4Credits)
MB 431 Paper IV Immunology and Medical Microbiology

Overall Course Objective:

Describe various infectious diseases in humans and study of immune responses against infections.

UNIT WISE COURSE OBJECTIVES:

COb1. List components of immune systems and types of immunity.
COb2. Explain immunological disorder and antigen-antibody reactions
COb3. Discuss the role of microbiota in human health and disease
COb4. Outline transmission and pathogenesis of various viral and parasitic diseases

Unit-1 Introduction to Immunology	**15 hrs**
Concept of haematopoiesis	1hr
Cells of immune system	2hr
Organs of immune system- primary and secondary lymphoid organs, Structure and classification of antigens, Factors affecting antigenicity	3hr
Antibodies- Basic structure, types, properties and functions of immunoglobulin	2hr
Types of immunity- innate and acquired, humoral and cell mediated immune responses.	3hr
Vaccines and its types	3hr
Major Histocompatability complex- Class I and II	1hr

Unit-2 Immunological Disorders and Ag-Ab reactions	**15 hrs**
Types of hypersensitivity- immediate and delayed	3hr
Systemic and localized autoimmune disorders	3hr
Complement pathways- classical and alternate	2hr
Types of Antigen- Antibody reactions- Agglutination, precipitation, neutralization, complement fixation tests. Labelled antibody based techniques- ELISA, RIA and Immunofluorescence	4hr
Polyclonal and monoclonal antibodies production and application	3hr

Unit-3 Medical Bacteriology	**15hrs**
Microbiota of human body	1hr
Infection; Properties of pathogenic microorganisms	2hr
Airborne diseases- Tuberculosis	3hr
Food and waterborne diseases- Cholera, Typhoid	2hr
Contact diseases- Syphilis, Gonorrhoea	3hr
General account on Nosocomial infections- *Staphylococcus aureus;* MRSA & *Pseudomonas*	3hr
Antimicrobial Resistance	1hr

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Unit-4 Medical Virology and Parasitology	**15 hr**
Water borne diseases- Poliomyelitis	2hr
Insect borne diseases- Malaria, Dengue, Filariasis	5 hr
Zoonotic diseases- Rabies, Toxoplasmosis	2hr
Contact Diseases- Hepatitis B, HIV	3hr
Air borne diseases- Influenza, SARS-CoV 2 (COVID-19)	3hr

REFERENCES:

1. Jawetz. Medical Microbiology and Immunology (2000), 6th Edition. Mc Graw Hill, New York.

2. Greenwood, David. Medical Microbiology (1997).15th Edition. Churchill Livingstone, New Delhi.

3. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India.

4. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.

5. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.

6. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical

7. Zaman, Hand book of Medical Parasitology 2nd Edition, K.C.publishers, Singapore.

8. Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.

9. Singh, R.P. (2007). Immunology and Medical Microbiology. Kalyani Publishers, New Delhi.

10. Franklin, DJ. and Snow GA. Biochemistry of antimicrobial action.Pub: Chapman & Hall.

11. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Antibiotics and Chemotherapy. Publ:Churchill Livingstone.

12. Williams, RAD., Lambart, PA. & Singleton, P. Antimicrobial Drug action. Pub:Bios Sci

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IV SEMESTER PRACTICALS (2 HPW-1Credit)
MB431 P Paper IV Immunology and Medical Microbiology - Practicals

1. Determination of Blood grouping and Rh typing
2. Total count of RBC and WBC
3. Differential count of Blood leucocytes
4. WIDAL test for typhoid(slide test) by Ag-Ab reactions
5. VDRL test for typhoid(slide test) by Ag-Ab reactions
6. Ouchterlony double diffusion test
7. Separation of serum and plasma
8. IMVIC test- Indole test, methyl red test, VogesProskauer test, Citrate utilization test
9. Oxidase test
10. Catalase test
11. Antibiotic sensitivity test- disc diffusion method
12. Observation of Malaria Parasite

REFERENCES:

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2. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
3. Samuel, K.M. (Ed.) (1989). Notes on Clinical Lab Techniques, M.K.G. Iyyer& Son Publishers, Chennai.
4. Wadher, B.J. and Reddy, G.L.B. (1995). Manual of Diagnostic Microbiology, Himalaya Publishing House, Mumbai
5. Mukherjee, K.L. (1996). Medical Laboratory Technology. Vol II. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
6. Cappuccino (2000), Microbiology Lab manual, Oxford University Press

COURSE OUTCOMES:

The student will be able to

MB 431. CO1. Evaluate the antimicrobial activity of antibiotics experimentally.
MB 431. CO2. Summarize methods of serological diagnosis.
MB 431. CO3. Summarize on various infectious diseases
MB 431. CO4. Interpret the disease based on symptoms and predict the diagnosis

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B. Sc MICROBIOLOGY (CBCS STRUCTURE)
SE 431A: CLINICAL MICROBIOLOGY
(2025 onwards)
IV SEMESTER (2 HPW-2Credits)

OVERALL COURSE OBJECTIVE:
Discuss the techniques and procedures in diagnosis of an infectious disease

UNIT WISE COURSE OBJECTIVES

This paper provides

COb1. Introduction to infectious diseases, specimen collection and media used to culture bacterial pathogens
COb2. Conceptual study of Kit based serological detection and Molecular methods of various human pathogens

Unit-1: **15Hrs**

Overview of infectious diseases-bacterial, viral, fungal, parasitic
Diagnostic Microbiology: Collection of clinical specimens and their processing -blood sample, Separation of blood components. Sputum, CSF, Stool, Urine, Swabs, Biopsy
Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria
Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Sabarouds Medium Distinct colony properties of various bacterial pathogens.

Unit-2 **15Hrs**

Kit based serological detection of Pathogens - Typhoid, Dengue, HIV, Swine flu, Syphilis.
Molecular methods of Diagnosis - PCR, Western blotting
Testing for Antibiotic sensitivity in Bacteria
Monitoring of Sanitation in Community – Biohazard Disposal.

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5. Wadher, B.J. and Reddy, G.L.B. (1995). Manual of Diagnostic Microbiology, Himalaya Publishing House, Mumbai

COURSE OUTCOMES

SE 431A. CO1. Acquaint knowledge on methods of clinical specimen collection, processing and culturing.

SE 431A. CO2. Understand various serological and molecular techniques to detect pathogenic Infections.

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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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