

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC A (3.02) State University

PATAN- 384265

Faculty of Science

B. Sc. Microbiology

Syllabus/ scheme

Semester – 5 to 6



With effect from

June-2025

Date: 03/07/2025

Total page: 20

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY PATAN	
B. Sc. (Microbiology) Syllabus 2025 (according to NEP-2020)	
Document code	Syllabus MIC- 2025
Name of faculty	Science
Faculty code	SCI
Programme name	B. Sc. MICROBIOLOGY
Programme code	SCIUG105
Effective from	June-2025

The proposed new structure for B. Sc. course is based on NEP-2020 which is in force June-2025.

Course Pattern

1. This programme is divided into **Eight Semesters** (Four Years). The duration of an academic year consists of two semesters, each of 15 weeks for teaching. The academic session in each semester will provide 90 teaching days. Each semester has 22 credits, and the programme is comprised of total 176 credits.
2. The theory courses with 4 credits shall have 60 hrs of direct classroom teaching workload (15 weeks \times 4). The theory courses with 3 credits shall have 45 hrs of teaching workload (15 weeks \times 3) and the theory courses with 2 credits shall have 30 hrs of teaching workload (15 weeks \times 2).

Attendance: The attendance rules will be as per the rules and regulation of Hemchandracharya North Gujarat University, Patan.

Medium of Instruction: The medium of instruction shall be Gujarati but students are free to write answers in Gujarati or English in examination.

Language of question paper: Question paper should be drawn in Gujarati and English translation of the questions must be given in the question paper.

Number of students in each batch for practical examination should be 15.

Evaluation

Continuation and Comprehensive Evaluation (CCE)

1. For CCE of 50 marks following component should be used.

Sr. No.	Component	Marks
1	Daily/Weekly/Monthly unit test/ Internal exam	25
2	Assignment/ Quiz test	10
3	Development of soft skill (Seminar/ Group discussion)	05
4	Solving exercise/ Work base training/ Reading analysis	05
5	Attendance	05
	Total	50

2. For CCE of 25 marks following component should be used.

Sr. No.	Component	Marks
1	Daily/Weekly/Monthly unit test/ Internal exam	15
2	Assignment/ Quiz test	05
4	Attendance	05
	Total	25

Semester End Evaluation (SEE)

1. For SEE of 50 marks following question paper style should be used.

	Total marks	
Q. 1	10	Must be drawn from Unit 1 and will have three long questions out of which any two must be answered (5 marks each)
Q. 2	10	Must be drawn from Unit 2 and will have three long questions out of which any two must be answered (5 marks each)
Q. 3	10	Must be drawn from Unit 3 and will have three long questions out of which any two must be answered (5 marks each)
Q. 4	10	Must be drawn from Unit 4 and will have three long questions out of which any two must be answered (5 marks each)
Q. 5	10	08 short questions must be drawn from all units, out of which any 05 must be answered (2 marks each)
Total	50	

2. For SEE of 25 marks following question paper style should be used.

	Total marks	
Q. 1	10	Must be drawn from Unit 1 and will have three long questions out of which any two must be answered (5 marks each)
Q. 2	10	Must be drawn from Unit 2 and will have three long questions out of which any two must be answered (5 marks each)
Q. 3	05	08 short questions must be drawn from both units, out of which any 05 must be answered (1 marks each)
Total	25	

PROGRAM OBJECTIVE

1. The primary objective of the program is to impart quality education in the subject of Microbiology as a basic science and its applied branches to the students.
2. To provide quality education in a branch of biological sciences i.e., Microbiology with different specializations.
3. To facilitate Higher education & research in Microbiology.
4. To provide quality education offering skill-based programs and motivate the students for self-employment in applied branches of Microbiology.
5. To inculcate the spirit of microbial resource conservation, utilization and also love for nature.
6. To provides opportunities for professional and personal development through curricular and co- curricular activities.
7. Provide consultancy and organize extension activities.

PROGRAMME OUTCOMES

1. To understand the complex organization of microbial world, physiology, immunology, bioprospecting and importance of microbes in various biogeochemical
2. cycles and for overall development.
3. For instance, if you major in Microbiology, you can also still take courses from across the other complementary.
4. Apply the wide range of subject based skills of various fields that provide a base for future career in disciplines such as Fermentation technology, Food microbiology, Environmental microbiology, Microbial biotechnology, Agriculture, Publishing, Teaching and Research.
5. Understand the applications of biological techniques to various fields of biology.
6. When you graduate with a Bachelor of Science (Microbiology) you can serve as academician in different institutes.
7. The syllabus has been designed in such a way that it will give good experience to the student to work under pressure.

B.Sc. Semester V (Microbiology)

Course	Course code	Paper title	Teaching hours per week	CCE	SEE	Total marks	Credit points	Exam duration (Hours)
Major Discipline Specific core course	SC23MJDSC MIC501	MEDICAL MICROBIOLOGY	4	50	50	100	4	2.30
Major Discipline Specific core course	SC23MJDSC MIC501AIKS	MICROBIOLOGY: VEDIC TO MODERN TIMES	4	50	50	100	4	2.30
Minor Disciplinary Course	SC23MIDC MIC502	CLINICAL AND DIAGNOSTIC MICROBIOLOGY	4	50	50	100	4	2.30
Major Discipline Specific core course Practical Paper	SC23PMJDSC MIC501	MEDICAL MICROBIOLOGY	4	25	25	50 (Part A) + 50 (Part B) = 100	2 (Part A) + 2 (Part B) = 4	More than 3
	SC23PMJDSC MIC501AIKS	MICROBIOLOGY: VEDIC TO MODERN SCIENCE	4	25	25			More than 3
Minor Discipline Specific core course Practical Paper	SC23PMIDC MIC502	CLINICAL AND DIAGNOSTIC MICROBIOLOGY	8	50	50	100	4	More than 3
Skill Enhancement Course	SC23SEC MIC506	MUSHROOM AND SPIRULINA CULTIVATION	2	25	25	50	2	2
Total			30	275	275	550	22	

B.Sc. Semester VI (Microbiology)

Course	Course code	Paper title	Teaching hours per week	CCE	SEE	Total marks	Credit points	Exam duration (Hours)
Major Discipline Specific core course	SC23MJDSC MIC601	ENVIRONMENTAL MICROBIOLOGY	4	50	50	100	4	2.30
Major Discipline Specific core course	SC23MJDSC MIC601A	WATER AND WASTE WATER MICROBIOLOGY	4	50	50	100	4	2.30
Minor Disciplinary Course	SC23MIDC MIC602	MICROBES AND ENVIRONEMNT	2	25	25	50	2	2.00
Major Discipline Specific core course Practical Paper	SC23PMJDSC MIC601	ENVIRONMENTAL MICROBIOLOGY	4	25	25	50 (Part A) + 50 (Part B) = 100	2 (Part A) + 2 (Part B) = 4	More than 3
	SC23PMJDSC MIC601A	WATER AND WASTE WATER MICROBIOLOGY	4	25	25			More than 3
Minor Discipline Specific core course Practical Paper	SC23PMIC MIC602	MICROBES AND ENVIRONEMNT	4	25	25	50	2	More than 3
Ability Enhancement Course	SC23AEC MIC604	ENGLISH	2	25	25	50	2	2.00
Internship	SC23INT MIC607	INTERNSHIP		50	50	100	4	
Total			30	275	275	550	22	

Semester VI

B.Sc. Semester VI (Microbiology)

Course	Course code	Paper title	Teaching hours per week	CCE	SEE	Total marks	Credit points	Exam duration (Hours)
Major Discipline Specific core course	SC23MJDSC MIC601	ENVIRONMENTAL MICROBIOLOGY	4	50	50	100	4	2.30
Major Discipline Specific core course	SC23MJDSC MIC601A	WATER AND WASTE WATER MICROBIOLOGY	4	50	50	100	4	2.30
Minor Disciplinary Course	SC23MIDC MIC602	MICROBES AND ENVIRONEMNT	2	25	25	50	2	2.00
Major Discipline Specific core course Practical Paper	SC23PMJDSC MIC601	ENVIRONMENTAL MICROBIOLOGY	4	25	25	50 (Part A) + 50 (Part B) = 100	2 (Part A) + 2 (Part B) = 4	More than 3
	SC23PMJDSC MIC601A	WATER AND WASTE WATER MICROBIOLOGY	4	25	25			More than 3
Minor Discipline Specific core course Practical Paper	SC23PMIC MIC602	MICROBES AND ENVIRONEMNT	4	25	25	50	2	More than 3
Ability Enhancement Course	SC23AEC MIC604	ENGLISH	2	25	25	50	2	2.00
Internship	SC23INT MIC607	INTERNSHIP		50	50	100	4	
Total			30	275	275	550	22	

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
COURSE NAME B. SC. MICROBIOLOGY SEMESTER VI

MAJOR DISCIPLINE SPECIFIC COURSE CODE: SC23MJDSCMIC601

Total credits 04 (04 periods/week)	Theory	External (50 marks)
		Internal (50 marks)

ENVIRONMENTAL MICROBIOLOGY

Unit 1 Microorganisms and their Habitats

- Structure and function of ecosystems,
- Terrestrial Environment: Soil profile and soil microflora,
- Aquatic Environment: Microflora of fresh water and marine habitats,
- Atmosphere: Aeromicroflora and dispersal of microbes,
- Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body.
- Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.

Unit 2 Microbial Interactions

- Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation
- Microbe-Plant interaction: Symbiotic and non symbiotic interactions
- Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria

Unit 3 Biogeochemical Cycling

- Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin
- Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction
- Phosphorus cycle: Phosphate immobilization and solubilisation
- Sulphur cycle: Microbes involved in sulphur cycle
- Other elemental cycles: Iron and manganese

Unit 4 Microbial Bioremediation and water potability

- Environmental laws, General process of Bioremediation, Factor affecting biodegradation, Biodegradation of organic pollutants.
- Mechanisms of Microbial Metal Resistance and Detoxification, Microbial Metal Transformations
- Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests

Outcomes:

- ✓ Students will know about fundamental aspects of environmental microbiology
- ✓ Students will learn the role of biogeochemical cycles for environment
- ✓ Students will gain knowledge different process of waster management and water potability.

References

1. Atlas RM and Bartha R. (2000). *Microbial Ecology: Fundamentals & Applications*. 4th edition. Benjamin/Cummings Science Publishing, USA
2. Madigan MT, Martinko JM and Parker J. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson/ Benjamin Cummings
3. Maier RM, Pepper IL and Gerba CP. (2009). *Environmental Microbiology*. 2nd edition, Academic Press
4. Okafor, N (2011). *Environmental Microbiology of Aquatic & Waste systems*. 1st edition, Springer, New York
5. Singh A, Kuhad, RC & Ward OP (2009). *Advances in Applied Bioremediation*. Volume 17, Springer-Verlag, Berlin Hedeilberg
6. Barton LL & Northup DE (2011). *Microbial Ecology*. 1st edition, Wiley Blackwell, USA
7. Campbell RE. (1983). *Microbial Ecology*. Blackwell Scientific Publication, Oxford, England.

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COURSE NAME B. SC. MICROBIOLOGY SEMESTER VI

MAJOR DISCIPLINE SPECIFIC COURSE CODE: SC23MJDSCMIC601A

Total credits 04 (04 periods/week)	Theory	External (50 marks)
		Internal (50 marks)

WATER AND WASTE WATER MICROBIOLOGY

OBJECTIVE:

To understand the description of different microorganisms persist in aquatic environment and role of microorganism in waste water treatment

UNIT-1: Microbiology of water

- Introduction: Natural waters- atmospheric water, surface water and ground water.
- Distribution of microorganisms in aquatic environment-Neuston, plankton (Phytoplankton, Zooplankton).
- Aquatic microorganisms-lakes, ponds, streams, rivers estuaries, and marine plankton. Lotic and benthic population.

UNIT-II Water pollution and quality of water

- Water pollution: Sources, water borne diseases- Viral (jaundice), Bacterial (cholera) and Protozoan (amoebic dysentery). Biological indicator of water pollution.
- Determination of sanitary quality of water: SPC, Tests for coliforms, MPN, IMViC reactions and membrane filter.
- Water purification in Municipal water supply, Parameters of potable water (WHO).

UNIT- III Microbiology of waste water

- Introduction: Sources of waste water- Domestic, Agricultural and Industrial. Physical, chemical and microbiological characteristics of waste water
- Waste water treatment: Single dwelling unit-Septic tank. Municipal waste treatment – Primary (screening, coagulation and sedimentation), Secondary (trickling filter,

activated sludge process, oxidation pond), Tertiary (reverse osmosis, ion exchange method and electro-dialysis in brief).

- Solid waste recycling- Anaerobic digestion process, Biogas and Composting.

UNIT-IV Microbes in extreme environments

- Microbes in extreme environments: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity & low nutrient levels.
- Microbial succession in decomposition of plant organic matter

Outcomes:

At the end of course student will be able

- To know about water and waste water microbial flora
- To know about treatment methods of waste water
- To aware about potability of water in terms of various chemical and biological parameters

Suggested Reading

1. Alexander A.M. 1987. Introduction to soil Microbiology, 5th ed., John Wiley and sons.
2. Atlas, R.M., and Bartha, R. (1993). Microbial Ecology: Fundamentals and applications, 3rd ed., Benjamin and Cummings Pub.Co.New york.
3. Daniel Environmental Microbiology
4. Grant W.D.P.E, Long: 1981 Environmental Microbiology, Thomson Litho ltd.
5. Maier and Pepper, Environmental Microbiology
6. Mehrotra R.S., Plant Pathology, Tata Mc Graw Hill Publications Limited, New Delhi.
7. Michael. J.Pelczar, Jr.E.C.S. Chan, Moel: Microbiology, Mc Graw Hill Book Company, New york).

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

COURSE NAME B. SC. MICROBIOLOGY SEMESTER VI

MAJOR DISCIPLINE SPECIFIC COURSE CODE: SC23PMJDSCMIC601

Total Credits- 04	Part A: 2 credits	(04 Period/Week)	Internal- 25 Marks	External-25 Marks	Total marks: 100
	Part B: 2 credits	(04 Period/Week)	Internal- 25 Marks	External-25 Marks	

LIST OF PRACTICALS

(PART A & B)

1. Isolation and identification of fungi from soil by serial dilution method.
2. Isolation and enumeration of bacteria from soil by serial dilution method.
3. Study of AM fungi
4. Isolation of Nitrogen fixing bacteria- Rhizobium
5. Study of antagonism between microorganisms
6. Isolation of airborne microorganisms (Bacteria and Fungi) by Petriplate exposure method.
7. Demonstration of air samplers: equipments / photographs of vertical cylindrical spore trap, Rotorod sampler, Hirst's spore trap, Andersen's sampler, Liquid impingement method (bead bubbler device) and Membrane filter.
8. Microscopic observation of different water samples for biological indicators of water pollution.
9. Standard analysis of water sample
10. Determination of MPN.
11. IMViC reactions.
12. Water quality test by Hydrogen sulphide strip test.
13. Display of photographs of water purification process (Baffles, Flocculator, Clarifier, Sand filter, Back wash, Chlorinometer and Chloroscope).
14. Determination of biological oxygen demand (BOD) of water.
15. Determination of chemical oxygen demand (COD) of water.
16. Estimation of total solids in sewage.
17. Display of photographs - Septic tank, Trickling filter, Activated sludge process, Oxidation ponds, Sedimentation tank, and anaerobic digester

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
COURSE NAME B. SC. MICROBIOLOGY SEMESTER VI

MINOR DISCIPLINE SPECIFIC COURSE CODE: SC23MIDSCMIC602

Total credits 02 (02 periods/week)	Theory	External (25 marks)
		Internal (25 marks)

**MICROBES AND ENVIRONMENT
(Minor)**

Course Objectives:

This course will help understand the current trends and a concept related to environment and microbes.

Unit 1: Habitats of microorganisms

- Structure and function of ecosystems, Aquatic Environment: Microflora of fresh water and marine habitats
- Atmosphere: Aeromicroflora and dispersal of microbes,
- Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body.
- Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.

Unit 2: Waste Management and Bioremediation

- Waste management: Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill).
- Liquid waste management: BOD and COD, Primary, secondary and tertiary sewage treatment.
- Microbial Bioremediation- Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants.

Course Outcomes:

- Students will know about fundamental aspects of environmental microbiology
- Students will learn the role of biogeochemical cycles for environment

- Students will gain knowledge different process of waste management.

References

1. Atlas RM and Bartha R. (2000). *Microbial Ecology: Fundamentals & Applications*. 4th edition. Benjamin/Cummings Science Publishing, USA
2. Madigan MT, Martinko JM and Parker J. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson/ Benjamin Cummings
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6. Barton LL & Northup DE (2011). *Microbial Ecology*. 1st edition, Wiley Blackwell, USA
7. Campbell RE. (1983). *Microbial Ecology*. Blackwell Scientific Publication, Oxford, England.

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COURSE NAME B. SC. MICROBIOLOGY SEMESTER V

MINOR DISCIPLINE SPECIFIC COURSE CODE: SC23PMIDSCMIC602

Total credits 04 (04 periods/week)	PRACTICAL	External (25 marks)
		Internal (25 marks)

**MICROBES AND ENVIRONMENT (Minor)
(PRACTICAL)**

List of Practicals

1. Microscopic observation of different water samples for biological indicators of water pollution.
2. Standard analysis of water sample
3. Determination of MPN.
4. IMViC reactions.
5. Water quality test by Hydrogen sulphide strip test.
6. Demonstration of air filtration by HEPA filter and its principle
7. Demonstration of air samplers: equipments / photographs of vertical cylindrical spore trap, Rotorod sampler, Hirst's spore trap, Andersen's sampler, Liquid impingement method (bead bubbler device) and Membrane filter.
8. Isolation of airborne microorganisms (Bacteria and Fungi) by Petriplate exposure method.
9. Effect of UV on air and water pathogens

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

COURSE NAME B. SC. MICROBIOLOGY SEMESTER V

PRACTICAL MAJOR DISCIPLINE SPECIFIC COURSE CODE:

SC23PMJDSCMIC601 & SC23PMJDSCMIC601A

PRACTICAL SKELETON

Time: more than 3 Hours

Total Marks: 50

PART A

Q 1		Experiment to perform	06
Q 2		Practical	06
Q 3		Do as directed. 1. A 2. B 3. C	06
Q 4	a	Viva-voce	03
	b	Journal	04

PART B

Q 1		Perform	05
Q 2		Write	04
Q 3		Do as directed: 1. A 2. B 3. C	06
Q 4		Spotting (part A and B)	04
Q 5	a	Viva-voce	03
	b	Journal	03

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
COURSE NAME B. SC. MICROBIOLOGY SEMESTER V

PRACTICAL MINORDISCIPLINARY SPECIFIC COURSE
CODE: SC23MIDCMIC602

PRACTICAL SKELETON

Time: more than 3 Hours

Total Marks: 50

Q 1	Practical	08
Q 2	Practical	04
Q 3	Do as directed. A B C D E F G H	16
Q 4	Submission / report	06
Q5	spoting	06
Q6	Viva-voce	05
Q7	Journal	05