

**Shri Manibhai Virani and Smt. Navalben Virani Science College**

**(Autonomous), Rajkot**

**Affiliated to Saurashtra University, Rajkot**

**11<sup>th</sup> Academic Council held on 20<sup>th</sup> June, 2023**

**APPENDIX J.2**

**Enclosures VI to XII of 13<sup>th</sup> BoS – Microbiology held on 22<sup>nd</sup> May, 2023**



**Sarvodaya Kelavani Samaj Managed**  
**Shri Manibhai Virani & Smt. Navalben Virani Science College, Rajkot**  
**(Autonomous)**

**Affiliated to Saurashtra University, Rajkot**

Reaccredited at the “A” Level (CGPA 3.28) by NAAC

“STAR” College Scheme & Status by MST-DBT

A College with Potential for Excellence – CPE (Phase - II) by UGC

Accredited at the G-AAA Highest Grade ‘A-1’ Level by KCG, Govt. of Gujarat

UGC-DDU KAUSHAL Kendra

GPCB-Government of Gujarat approved Environmental Audit Centre

## **SCHEME OF LEARNING AND EVALUATION**

( based on the recommendations for 4 years UG program under the Curriculum and Credit Framework for Undergraduate Programs – guidelines / framework / regulations of UGC , Gujarat Government and affiliating Saurashtra University in light of NEP-2020)

**Of**

**Bachelor of Science (Honors/Honors with Research (FYUGP)) –  
MICROBIOLOGY Programme**

**(W.e.f June 2023)**

**Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot**  
**(Autonomous)**  
**Affiliated to Saurashtra University, Rajkot**  
**Department of Microbiology**  
**B.Sc. / B.Sc. (Honours) MICROBIOLOGY PROGRAMME**  
**Regulations for Students Admitted from A.Y. 2023-2024 & Onwards**

**ELIGIBILITY**

Candidate who has passed Higher Secondary Certificate (10+2) examination with Science subjects in respective streams of Gujarat State or any other examination recognized as equivalent thereto with a good academic record, shall be eligible for admission, subject to such other conditions prescribed by the Parent University and State Government from time to time. All admissions are provisional and subject to the approval of Parent University.

**LATERAL ENTRY**

Candidates seeking admission directly in third semester of B.Sc. / B.Sc. (Honours) Microbiology must have passed examination of Diploma in Pharmacy or relevant subjects to be eligible for admission. A result of this type of candidate will be declared by considering his/her marks of semester 3 to 6 / 8 in aggregate and accordingly class will be awarded.

**DURATION OF THE PROGRAMME**

The Program

1. Shall extend over a period of three / four years comprising of six / eight semesters for the fresh Entrants. For lateral Entrants, it shall of two / three years comprise of four / six semesters
2. Comprises of two semesters in one academic year wherein each semester normally will be of minimum 90 teaching days.

**CHOICE BASED CREDIT SYSTEM (CBCS)**

The CBCS provides an opportunity for the students to choose courses from the prescribed courses based on their interest. Mainly, each course is worth a certain number of credit points, determined by different criteria including learning outcome, contact hours etc.

The following mechanism is adopted for the purpose of computation of credits earned by the students:

- a. 1-hour instruction of Theory = 1 Credit
- b. 1- hours instruction of Tutorial = 1 Credit
- c. 2- hours instructions of Practical = 1 Credit

## **OUTCOME BASED EDUCATION (OBE)**

Outcome based education is based on revised Bloom Taxonomy and is a learner-centric teaching and learning methodology in which the course delivery and assessment are planned to achieve stated objectives and outcomes. It focuses on measuring students performance i.e. outcomes at different levels. OBE method of learning is adopted.

## **STRUCTURE OF THE PROGRAMME**

UG program shall have a curriculum comprising theory and practical (separate / in built with theory) courses with a specified syllabus. The curriculum of the program is a blend of Language Courses, Core Courses, Interdisciplinary Courses (IDC), Discipline Specific Electives (DSE), Trans-disciplinary Electives (TDE) and Ability Enhancement Courses (AEC) shall be offered.

## **MEDIUM OF INSTRUCTION AND EXAMINATIONS**

The medium of instruction and examinations shall be English, except for courses on Languages other than English.

## **EVALUATION**

The evaluation shall generally comprise of Continuous Internal Assessment (CIA) and Semester End Examination (SEE) with percentage weightage as specified below, unless specified otherwise in the Scheme of Learning and Evaluation.

<b>Components</b>	<b>Theory Courses</b>	<b>Practical Courses</b>
Continuous Internal Assessment (CIA)	Varies from 30 percent to 100 percent based on the nature of course.	Varies from 40 percent to 100 percent based on the nature of course.
Semester End Examination (SEE)	Varies from 70 percent to 0% percent based on the nature of course.	Varies from 40 percent to 60 percent based on the nature of course.

## **COMPLETION OF PROGRAM TO EARN THE DEGREE CERTIFICATE**

The University shall publish the result after evaluation and with the recommendations of Result Passing Board at the end of each semester. On approval / ratification of the results by the Academic Council, the student will be recommended to Governing Body for the award of the degree provided that the student have earned all the credits towards mandatory course / components as mentioned in Scheme of Learning and Evaluation.

## **MINIMUM QUALIFICATION FOR APPOINTMENT OF FACULTY MEMBER**

As per norms of UGC and./or other related Regulatory body

**Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot  
(Autonomous)  
Affiliated to Saurashtra University, Rajkot**

**Department of Microbiology  
B. Sc. MICROBIOLOGY**

**VISION OF THE DEPARTMENT**

Our vision is to produce highly qualified and competent microbiologists with expertise in all the relevant areas, to develop and maintain a strong and supportive research programme to complement our national needs while strengthening local relevance and to rise as centre of excellence and knowledge in the subject of Microbiology

**MISSION OF THE DEPARTMENT**

The Mission of Microbiology Department is to promote good quality education, research and to provide the most rigorous and inspiring training in the discipline of Microbiology with greater significance of application in all relevant areas. The Department strives to educate and mentor students to:

- Acquire practical skills necessary for operation and maintenance of small and medium scale industry and research institute,
- Be aware of the role of microorganisms in various aspects of life processes and understand their importance in agriculture, environment, food, health, and other areas,
- Apply microbiological techniques and technologies to the betterment of human life, environment and national economy,
- Contribute to the pursuit of knowledge by contributing meaningfully in the area of Research in Microbiology

**OBJECTIVES OF THE PROGRAMME**

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. This programme will enable students to understand the basic anatomy, physiology, diversity, and genetics of microorganisms including viruses, bacteria, protozoa, algae and fungi, and exploit their interactions with environment and human beings.
2. The Curriculum is designed to impart to students the skill to operate basic and advanced instruments used for analysis of various biomolecules.
3. This programme will enable students to acquire knowledge on the Microbiology, Cell Biology, Microbiology, Immunology, Bioprocess Technology and Molecular Biology to enable them to understand emerging and advanced concept in modern biology and help them to take their career in this field.
4. After completion of the programme, the students will be able to acquire the necessary theoretical and practical competencies in Microbiology to enable them to undertake higher studies in recognized Institutions of advance learning and engage gainful self-employment.

5. The Programme is intended to help the students to be the innovative and versatile personalities in the field of Life Science with quality education and provide the skilled manpower required by Research and Development, Institutions of Higher Learning and Industry.

## GRADUATE ATTRIBUTES

- **Academic excellence:** Ability to identify key questions, research and pursue rigorous evidence-based arguments.
- **Critical Thinking and Effective communications:** Analysis and evaluation of information to form a judgment about a subject or idea and ability to effectively communicate the same in a structured form.
- **Global Citizenship:** Mutual understanding with others from diverse cultures, perspectives and backgrounds
- **Life Long Learning:** Open, curious, willing to investigate, and consider new knowledge and ways of thinking

## PROGRAM EDUCATIONS OBJECTIVES (PEOs)

This programme will produce Graduates who will attain following PEOs after few years of graduation	
<b>PEO 1</b>	: <b>Core competency:</b> will develop the competency to pursue higher education, successful professional career, or be an entrepreneur with synergistic combination of the knowledge and skills of Microbiology and allied sciences
<b>PEO 2</b>	: <b>Breadth of knowledge:</b> will show the ability to critically analyse scientific data, drawing objective conclusions from it and apply this knowledge to independently design, and execute small research problems with the help of integrated knowledge of Microbiology and other domains for societal and human welfare.
<b>PEO 3</b>	: <b>Preparedness:</b> will have the potential to take any task or assignment in the capacity of a leader or team member in the chosen occupations or careers and will reflect an aptitude and ability for contribution in academics, entrepreneurship, and research, equipped with good communication skills.
<b>PEO 4</b>	: <b>Professionalism:</b> will possess strong professional ethics and expertise to fulfil moral duties towards their profession, community, society and nation at large.
<b>PEO 5</b>	: <b>Learning environment:</b> will show readiness for lifelong learning necessary to meet the ever evolving professional, social and personal demands through ethical, interpersonal and team skills.

## PROGRAM OUTCOMES:

After completion of the B.Sc. Microbiology programme, the Graduate will be able to:		
<b>PO 1</b>	:	<b>Domain knowledge:</b> Demonstrate an understanding of fundamental principles of Microbiology, its applications and scope, along with an ability to identify beneficial and harmful role of microorganisms for the benefit of Science and Society
<b>PO 2</b>	:	<b>Problem analysis:</b> Accurately identify and critically analyse pertinent problems in the field of Applied Microbiology and various domains of Biological sciences.
<b>PO 3</b>	:	<b>Design/development of solutions:</b> Search for and successfully arrive at viable conclusions/solutions pertaining to various aspects of life sciences using right approach and appropriate tools and techniques
<b>PO 4</b>	:	<b>Conduct investigations of complex problems:</b> Ability to investigate any complex problems related to Microbiology and other life science with the use of appropriate experimental tools/techniques/equipment.
<b>PO 5</b>	:	<b>Modern tool usage:</b> Understand standard operating procedures, safety measures and acquire in-depth technical competence to handle the basic laboratory instruments, and develop the skills to locate and retrieve scientific information with modern data search tools.
<b>PO 6</b>	:	<b>The Microbiologist and Society:</b> Demonstrate the ability to understand the role of scientific developments in a changing world from the disciplinary perspective as well as in relation to its professional and everyday use, with an insight into one's role in society and act in an honest and consistent manner based on a strong sense of self and personal values.
<b>PO 7</b>	:	<b>Environment and sustainability:</b> Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development.
<b>PO 8</b>	:	<b>Ethics:</b> Commitment to professional ethics and responsibilities.
<b>PO 9</b>	:	<b>Individual and team work:</b> Exhibit the potential to effectively accomplish tasks as a leader or a member of a team as well as independently in multidisciplinary settings.
<b>PO 10</b>	:	<b>Communication:</b> Communicate effectively in spoken and written forms as well as through digital media with scientific community, society, and fellow mates.
<b>PO 11</b>	:	<b>Project management and finance:</b> Demonstrate knowledge and scientific understanding to design a research project and manage its execution to generate new scientific insights, innovations in Microbiology research and exhibit organizational skills for able management of time and resources.
<b>PO 12</b>	:	<b>Life-long learning:</b> Able to recognize the need to undertake life-long learning and acquire the capacity to build on critical thinking skills for periodic updating of scientific knowledge and its application.

## PROGRAM SPECIFIC OUTCOMES (PSOs) for B. Sc. Microbiology programme

After completion of the programme, the Graduate will:	
<b>PSO1</b>	: Acquire knowledge on the fundamentals of Microbiology for sound and solid base which enables them to understand the emerging and advanced concepts in life sciences
<b>PSO2</b>	: To equip the students with knowledge, skill and inspiration to pursue higher education and research in Microbiology and allied fields in reputed institutes at national and international level.
<b>PSO3</b>	: Be able to understand fundamental principles of Microbiology to find innovative solutions for environment, agriculture, and health related issues at local and global level.
<b>PSO4</b>	: Apply the knowledge of Microbiology, preferably with the synergistic application of basic understanding of other allied fields, for finding sustainable ethical solutions to existing global problems in compliance to the SDGs
<b>PSO5</b>	: Become competent and eligible to appear in various competitive exams, getting placement in government and private sectors of academia, research and industries, and become a successful Microbiologist serving the Nation.



**ENCLOSURE – VII**

**Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot**  
(An Autonomous College affiliated to Saurashtra University, Rajkot)

**Department of Microbiology**

**Bachelor of Science (Hon/Hon with Research (FYUGP))**

**SCHEME OF LEARNING AND EVALUATION**

**For the students admitted from A.Y. 2023-2024& onwards**

**NCrF- Level 4.5: First Year FYUGP: Semester I & II (UG Certificate in Sciences)**

<b>Semester I</b>									
<b>Course Code</b>	<b>Course</b>	<b>Contact Hrs./ week</b>			<b>SEE Duration (Hours)</b>	<b>Maximum Marks</b>			<b>Credits</b>
		<b>T</b>	<b>Tu</b>	<b>P</b>		<b>CIA</b>	<b>SEE</b>	<b>Total</b>	
<b>Part-I: Ability Enhancement Courses (Language)</b>									
		<b>T</b>	<b>Tu</b>	<b>P</b>					
	English - I	2	-	-	3	2 Assg	50	50	2
<b>Part-I Total</b>		<b>2</b>	<b>0</b>	<b>0</b>		<b>-</b>	<b>50</b>	<b>50</b>	<b>2</b>
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 1:</b> Fundamentals of Microbiology	4	-	-	3	30	70	100	4
	<b>Core 2:</b> Biochemistry – I	4	-	-	3	30	70	100	4
	<b>Core Practical-1:</b> Fundamentals of Microbiology	-		4	4*	15	35	50	2
	<b>Core Practical - 2:</b> Biochemistry – I	-		4	4*	15	35	50	2
<b>Minor Stream / DMi / IDMiCore Courses</b>									
	<b>DMi Core 1:</b> Biology – I	4	-	-	3	30	70	100	4
	<b>DMi Core Practical- 1:</b> Biology – I			4	4*	15	35	50	2
<b>Multi-Disciplinary Courses:(MDC)</b>									
	<b>MDC 1:</b>	2	-	-	2	50	-	50	2
<b>Skill Enhancement Courses (SEC Major &amp; Minor)</b>									
	Vermicomposting	1	-	-	2	50	-	50	1
<b>Part-II Total</b>		<b>15</b>	<b>0</b>	<b>12</b>		<b>235</b>	<b>315</b>	<b>550</b>	<b>21</b>
<b>Part-III</b>									
<b>Common Value-Added Course (CVAC)</b>									
	Jeevan Vidya	1	-	-	-	50	-	50	1
		<b>18</b>	<b>0</b>	<b>12</b>					
<b>Part-I+II+III Total</b>		<b>30</b>				<b>285</b>	<b>365</b>	<b>650</b>	<b>24</b>

**Multi-disciplinary course offered by the Department to Semester – I students of other Departments.**

<b>Multi-disciplinary course (MDC)</b>									
	Microbes in Human welfare	<b>2</b>	-	-	<b>2</b>	<b>50</b>	-	<b>50</b>	<b>2</b>

**\* 2 days practical exam:2hrs on day 1 and 2hrs on day 2**

**SCHEME OF LEARNING AND EVALUATION**  
For the students admitted from A.Y. 2023-2024& onwards

<b>Semester II</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
<b>Part-I: Ability Enhancement Courses (Language)</b>									
		<b>T</b>	<b>Tu</b>	<b>P</b>					
	English - II	2	-	-	3	2 Assg	50	50	2
	<b>Part-I Total</b>	<b>2</b>	<b>0</b>	<b>0</b>		<b>-</b>	<b>50</b>	<b>50</b>	<b>2</b>
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 3:</b>	4	-	-	3	30	70	100	4
	<b>Core 4:</b>	4	-	-	3	30	70	100	4
	<b>Core Practical-3:</b>	-		4	4*	15	35	50	2
	<b>Core Practical -4:</b>	-		4	4*	15	35	50	2
<b>Minor Stream / DMi / IDMiCore Courses</b>									
	<b>DMi Core 2:</b>	4	-	-	3	30	70	100	4
	<b>DMi Core Practical- 2:</b>			4	4*	15	35	50	2
<b>Multi-Disciplinary Courses:(MDC)</b>									
	<b>MDC 2:</b>	2	-	-	2	50	-	50	2
<b>Skill Enhancement Courses (SEC Major &amp; Minor)</b>									
	<b>SEC – 2: (Major)</b>	1	-	-	2	50	-	50	1
	<b>Part-II Total</b>	<b>15</b>	<b>0</b>	<b>12</b>		<b>235</b>	<b>315</b>	<b>550</b>	<b>21</b>
<b>Part-III</b>									
<b>Common Value-Added Course (CVAC)</b>									
	<b>CVAC – 2</b>	1	-	-	-	50	-	50	1
		<b>18</b>	<b>0</b>	<b>12</b>					
	<b>Part-I+II+III Total</b>	<b>30</b>				<b>285</b>	<b>365</b>	<b>650</b>	<b>24</b>

Multi-disciplinary course offered by the Department to Semester – II students of other Departments.

<b>Multi-disciplinary course (MDC)</b>									
	<b>MDC 2:</b>	2	-	-	2	50	-	50	2

\* 2 days practical exam:2hrs on day 1 and 2hrs on day 2

**SCHEME OF LEARNING AND EVALUATION**  
**For the students admitted from A.Y. 2023-2024& onwards**  
**NCrF- Level 5: Second Year FYUGP: Semester III & IV (UG Diploma in Sciences)**

<b>Semester III</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
		T	Tu	P		CIA	SEE	Total	
<b>Part-I: Ability Enhancement Courses (Language)</b>									
		T	Tu	P					
	English – III	2	-	-	3	2 Assg	50	50	2
<b>Part-I Total</b>		<b>2</b>	<b>0</b>	<b>0</b>		<b>-</b>	<b>50</b>	<b>50</b>	<b>2</b>
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 5:</b>	4	-	-	3	30	70	100	4
	<b>Core 6:</b>	4	-	-	3	30	70	100	4
	<b>Core Practical-5:</b>	-		4	4*	15	35	50	2
	<b>Core Practical -6:</b>	-		4	4*	15	35	50	2
<b>Minor Stream / DMi / IDMiCore Courses</b>									
	<b>DMi Core 3:</b>	4	-	-	3	30	70	100	4
	<b>DMi Core Practical- 3:</b>			4	4*	15	35	50	2
<b>Multi-Disciplinary Courses:(MDC)</b>									
	<b>MDC 3:</b>	2	-	-	2	50	-	50	2
<b>Skill Enhancement Courses (SEC Major &amp; Minor)</b>									
	<b>SEC – 3: (Major)</b>	1	-	-	2	50	-	50	1
<b>Part-II Total</b>		<b>15</b>	<b>0</b>	<b>12</b>		<b>235</b>	<b>315</b>	<b>550</b>	<b>21</b>
<b>Part-III</b>									
<b>Common Value-Added Course (CVAC)</b>									
	<b>CVAC –3</b>	1	-	-	-	50	-	50	1
		<b>18</b>	<b>0</b>	<b>12</b>					
<b>Part-I+II+III Total</b>		<b>30</b>				<b>285</b>	<b>365</b>	<b>650</b>	<b>24</b>

**Multi-disciplinary course offered by the Department to Semester – III students of other Departments.**

<b>Multi-disciplinary course (MDC)</b>									
	<b>MDC 3:</b>	2	-	-	2	50	-	50	2

**\* 2 days practical exam:2hrs on day 1 and 2hrs on day 2**

**SCHEME OF LEARNING AND EVALUATION**  
For the students admitted from A.Y. 2023-2024& onwards

<b>Semester IV</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
		T	Tu	P		CIA	SEE	Total	
<b>Part-I: Ability Enhancement Courses (Language)</b>									
		T	Tu	P					
	English – IV	2	-	-	3	2 Assg	50	50	2
	<b>Part-I Total</b>	<b>2</b>	<b>0</b>	<b>0</b>		<b>-</b>	<b>50</b>	<b>50</b>	<b>2</b>
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 7:</b>	4	-	-	3	30	70	100	4
	<b>Core 8:</b>	4	-	-	3	30	70	100	4
	<b>Core Practical-7:</b>	-		4	4*	15	35	50	2
	<b>Core Practical -8:</b>	-		4	4*	15	35	50	2
<b>Minor Stream / DMi / IDMiCore Courses</b>									
	<b>DMi Core 4:</b>	4	-	-	3	30	70	100	4
	<b>DMi Core Practical- 4:</b>			4	4*	15	35	50	2
<b>Multi-Disciplinary Courses:(MDC)</b>									
	<b>MDC 4: TDE 1</b>	1	-	-	2	50	-	50	1
<b>Skill Enhancement Courses (SEC Major &amp; Minor)</b>									
	<b>SEC – 4: CoC</b>	2	-	-	2	50	-	50	2
	<b>Part-II Total</b>	<b>15</b>	<b>0</b>	<b>12</b>		<b>235</b>	<b>315</b>	<b>550</b>	<b>21</b>
<b>Part-III</b>									
<b>Common Value-Added Course (CVAC)</b>									
	<b>CVAC –4</b>	1	-	-	-	50	-	50	1
		<b>18</b>	<b>0</b>	<b>12</b>					
	<b>Part-I+II+III Total</b>	<b>30</b>				<b>285</b>	<b>365</b>	<b>650</b>	<b>24</b>

Multi-disciplinary course offered by the Department to Semester – IV students of other Departments.

<b>Multi-disciplinary course (MDC)</b>									
	<b>MDC 4: TDE 1</b>	2	-	-	2	50	-	50	2

\* 2 days practical exam:2hrs on day 1 and 2hrs on day 2

**SCHEME OF LEARNING AND EVALUATION**  
**For the students admitted from A.Y. 2023-2024& onwards**  
**NCrF- Level 5.5: Third Year FYUGP: Semester V&VI (B.Sc. in Microbiology)**

<b>Semester V</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
		T	Tu	P		CIA	SEE	Total	
<b>Part-I: Ability Enhancement Courses (Language)</b>									
		<b>T</b>	<b>Tu</b>	<b>P</b>					
	MIL – Hindi**	2	-	-	3	2 Assg	50	50	2
<b>Part-I Total</b>		<b>2</b>	<b>0</b>	<b>0</b>		<b>-</b>	<b>50</b>	<b>50</b>	<b>2**</b>
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 9:</b>	4	-	-	3	30	70	100	4
	<b>Core 10:</b>	4	-	-	3	30	70	100	4
	<b>Core 11:</b>	4	-	-	3	30	70	100	4
	<b>Core Practical-9:</b>	-		4	4*	15	35	50	2
	<b>Core Practical -10:</b>	-		4	4*	15	35	50	2
	<b>Core Practical -11:</b>	-		4	4*	15	35	50	2
<b>Core Elective</b>									
	<b>Core Elective 1:</b>	3	-	-	3	30	70	100	3
<b>Research Project / Dissertation</b>									
	<b>Minor Research Project (Ma) / Industrial visit / Training**</b>	-	-	-	-	Evaluation in the 6 <sup>th</sup> Semester			-
<b>Skill Enhancement Courses (SEC Major &amp; Minor)</b>									
	<b>SEC – 5: Internship (Major)</b>	-	-	4	-	50	-	50	2
<b>Part-II Total</b>		<b>15</b>	<b>0</b>	<b>16</b>		<b>215</b>	<b>435</b>	<b>600</b>	<b>23</b>
<b>Part-III</b>									
<b>Common Value-Added Course (CVAC)</b>									
	<b>CVAC –5</b>	1	-	-	-	50	-	50	1
		<b>16/18</b>	<b>0</b>	<b>16</b>					
<b>Part-I+II+III Total</b>		<b>32/34</b>				<b>285</b>	<b>365</b>	<b>650</b>	<b>24</b>

\* 2 days practical exam: 2hrs on day 1 and 2hrs on day 2

\*\* Extra Credit course

**SCHEME OF LEARNING AND EVALUATION**  
For the students admitted from A.Y. 2023-2024& onwards

<b>Semester VI</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
		T	Tu	P		CIA	SEE	Total	
<b>Part-I: Ability Enhancement Courses (Language)</b>									
		T	Tu	P					
	MIL – Hindi**	2	-	-	3	2 Assg	50	50	2
<b>Part-I Total</b>		<b>2</b>	<b>0</b>	<b>0</b>		<b>-</b>	<b>50</b>	<b>50</b>	<b>2**</b>
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 12:</b>	4	-	-	3	30	70	100	4
	<b>Core 13:</b>	4	-	-	3	30	70	100	4
	<b>Core 14:</b>	4	-	-	3	30	70	100	4
	<b>Core Practical-12:</b>	-		4	4*	15	35	50	2
	<b>Core Practical -13:</b>	-		4	4*	15	35	50	2
	<b>Core Practical -14:</b>	-		4	4*	15	35	50	2
<b>Core Elective</b>									
	<b>Core Elective 2:</b>	3	-	-	3	30	70	100	3
<b>Multi-Disciplinary Courses:(MDC)</b>									
	<b>MDC 5: TDE 2</b>	1	-	-	2	50	-	50	1
<b>Research Project / Dissertation</b>									
	<b>Minor Research Project (Ma) / Industrial visit / Training**</b>	-	-	-	-	Evaluation in the 6 <sup>th</sup> Semester			2**
<b>Skill Enhancement Courses (SEC Major &amp; Minor)</b>									
	<b>SEC – 6:CRT* +SS (NCC)*</b>	1	-		-	50	-	50	1
<b>Part-II Total</b>		<b>17</b>	<b>0</b>	<b>16</b>		<b>265</b>	<b>435</b>	<b>650</b>	<b>23</b>
<b>Part-III</b>									
<b>Common Value-Added Course (CVAC)</b>									
	<b>CVAC –6</b>	1	-	-	-	50	-	50	1
		<b>17/19</b>	<b>0</b>	<b>16</b>					
<b>Part-I+II+III Total</b>		<b>33/35</b>				<b>315</b>	<b>435</b>	<b>700</b>	<b>24</b>

\* Non-credit compulsory course

**SCHEME OF LEARNING AND EVALUATION**  
For the students admitted from A.Y. 2023-2024& onwards  
NCrF- Level 6: Fourth Year FYUGP: Semester VII & VIII  
(B.Sc. Honours or B.Sc. Honours with Research)

<b>Semester VII(B.Sc. Honours)</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 15:</b>	4	-	-	3	30	70	100	4
	<b>Core 16:</b>	4	-	-	3	30	70	100	4
	<b>Core 17:</b>	4	-	-	3	30	70	100	4
	<b>Core Practical-15:</b>	-	-	4	4*	15	35	50	2
	<b>Core Practical -16:</b>	-	-	4	4*	15	35	50	2
	<b>Core Practical -16:</b>	-	-	4	4*	15	35	50	2
<b>Core Elective</b>									
	<b>Core Elective 3:</b>	4	-	-	3	30	70	100	4
	<b>Core Elective 3 Practical:</b>	-	-	4	4*	15	35	50	2
<b>Part-II Total</b>		<b>16</b>	<b>0</b>	<b>16</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>
<b>Part-I+II+III Total</b>		<b>32</b>				<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

\* 2 days practical exam:2hrs on day 1 and 2hrs on day 2

**SCHEME OF LEARNING AND EVALUATION**  
For the students admitted from A.Y. 2023-2024& onwards

<b>Semester VIII(B.Sc. Honours)</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 18:</b>	4	-	-	3	30	70	100	4
	<b>Core 19:</b>	4	-	-	3	30	70	100	4
	<b>Core 20:</b>	4	-	-	3	30	70	100	4
	<b>Core Practical-18:</b>	-	-	4	4*	15	35	50	2
	<b>Core Practical -19:</b>	-	-	4	4*	15	35	50	2
	<b>Core Practical -20:</b>	-	-	4	4*	15	35	50	2
<b>Core Elective</b>									
	<b>Core Elective 4:</b>	4	-	-	3	30	70	100	4
	<b>Core Elective 4 Practical:</b>	-	-	4	4*	15	35	50	2
<b>Part-II Total</b>		<b>16</b>	<b>0</b>	<b>16</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>
<b>Part-I+II+III Total</b>		<b>32</b>				<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

\* 2 days practical exam:2hrs on day 1 and 2hrs on day 2



**SCHEME OF LEARNING AND EVALUATION**  
**For the students admitted from A.Y. 2023-2024& onwards**  
**NCrF- Level 6: Fourth Year FYUGP: Semester VII & VIII**  
**(B.Sc. Honours or B.Sc. Honours with Research)**

<b>Semester VII (B.Sc. Honours with Research)</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 15:</b>	4	-	-	3	30	70	100	4
	<b>Core 16:</b>	4	-	-	3	30	70	100	4
	<b>Core 17:</b>	4	-	-	3	30	70	100	4
	<b>Core Practical-15:</b>	-	-	4	4*	15	35	50	2
	<b>Core Practical -16:</b>	-	-	4	4*	15	35	50	2
	<b>Core Practical -16:</b>	-	-	4	4*	15	35	50	2
<b>Core Elective</b>									
	<b>Core Elective 3:</b>	4	-	-	3	30	70	100	4
	<b>Core Elective 3 Practical:</b>	-	-	4	4*	15	35	50	2
<b>Part-II Total</b>		<b>16</b>	<b>0</b>	<b>16</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>
<b>Part-I+II+III Total</b>		<b>32</b>				<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

\* 2 days practical exam:2hrs on day 1 and 2hrs on day 2

**SCHEME OF LEARNING AND EVALUATION**  
**For the students admitted from A.Y. 2023-2024& onwards**

<b>Semester VIII (B.Sc. Honours with Research )</b>									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
<b>Part-II: Discipline Specific Core Courses</b>									
<b>Major Core / DSC/ IDMajor</b>									
	<b>Core 21 including MOOC</b>	4	-	-	3	30	70	100	4
	<b>Core 22 including MOOC</b>	4	-	-	3	30	70	100	4
<b>Research Project</b>									
	<b>Major Research Project</b>	4	-	24	3	120	280	400	16
<b>Part-II Total</b>		<b>12</b>	<b>0</b>	<b>24</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>
<b>Part-I+II+III Total</b>		<b>36</b>				<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

**Syllabus – Semester – I**Department: **Microbiology**Programme: **B.Sc. Microbiology**

Course Code	Course Title (F)	Credits
23UMBCC101	Core 1: Fundamentals of Microbiology (F)	4 Credits

**Course Description:**

Introduction to Microbiology is appropriate for students with some background in the fundamentals of the omnipresent microbes in biosphere. This is a career path intersects the study of microbes or simply have an interest in microbiology. This course introduces the basic principles of microbiology that examining the microbes and their effect on the environment. Introduction to Microbiology explores the impact through the lens of all areas of microbiology. From this subject student will be able identify challenges and opportunities that arise from the understanding of historical era, distribution pattern of microbes into the biosphere, nutritional parameters for the cultivation and preservation of microbes through the lectures, group activities, class test and homework projects.

**Course Objectives:**

1. Identify major contributions of the early scientists, their contributions that laid the groundwork for modern microbiology.
2. Understand the bacterial classification, characteristics of prokaryotic cells and eukaryotic cells and major groups of microorganisms.
3. Outline the structural and functional differences among all the microbes such as morphological features of bacterial cell and its organelles.
4. Understand the influence of microbes in their natural environments on maintenance of the nutritional requirements of microbes.

Explain the underlying facts of cultivation and preservation processes of microorganisms.

<b>Course Outcomes:</b> Upon completion of this course, the learner will be able to		
CO No.	CO Statement	Blooms taxonomy Level (K1 to K4)
CO <sub>1</sub>	Identify the pioneers of the subject and interpret their contributions that laid the groundwork for modern microbiology.	K2

CO <sub>2</sub>	Demonstrate and relate the characteristic features of prokaryotic and eukaryotic cells and major groups of microorganisms and diversity of microbial world with the cultivation and preservation methods of microorganisms.	K2
CO <sub>3</sub>	To relate and describe the flow of structural and functional differences among all the microbes and their nutritional requirements for the microbial growth.	K2
CO <sub>4</sub>	Identify the influence of microbiology and 21 <sup>st</sup> century challenges and opportunities that arise from our changing relationship with and understanding of microbes.	K2
CO <sub>5</sub>	Relate the science of microbes and the social issues and concerns relevant to the field of microbiology.	K2

<b>Course Content</b>	<b>Hours</b>
<b>Unit 1: Scope and History of Microbiology</b>	<b>10 hrs</b>
<ul style="list-style-type: none"> <li>• Microbiology as a field of Biology</li> <li>• Mile stones of Microbiology</li> <li>• The Place of Microorganisms in the living world; Distribution of Microorganisms in Nature</li> <li>• Spontaneous generation versus Biogenesis; Germ Theory of disease</li> <li>• Applied areas of Microbiology</li> </ul>	
<b>Unit 2: Major Groups of Microorganisms</b>	<b>10 hrs</b>
<ul style="list-style-type: none"> <li>• Difference between Eukaryotes, Prokaryotes and Archaea</li> <li>• Major groups of Microorganisms</li> <li>• Bacteria: General characteristics</li> <li>• Eukaryotic Microorganisms: Fungi, Algae, Protozoa</li> <li>• Viruses: Plant, Animal Viruses, Bacteriophages</li> </ul>	
<b>Unit 3: Microscopy</b>	<b>10 hrs</b>
<ul style="list-style-type: none"> <li>• Microscopy: Introduction and Types</li> <li>• Principle, Construction and working of: Bright field Microscopy, Dark field Microscopy, Fluorescent Microscopy, Phase Contrast Microscopy</li> <li>• Introduction to Advanced Microscopic techniques: Confocal microscopy</li> <li>• Electron Microscopy – Types, working and Limitations</li> <li>• Preparation of sample for Electron Microscopy</li> </ul>	
<b>Unit 4: Staining</b>	<b>10 hrs</b>
<ul style="list-style-type: none"> <li>• Stains and staining solutions</li> </ul>	

<ul style="list-style-type: none"> <li>• Types of Stains: Natural, Acidic &amp; Basic Stains</li> <li>• Chromophore &amp; Auxochrome groups, Leuco compounds</li> <li>• Theories and types of Staining</li> <li>• Non-Biological uses of stains</li> </ul>	
<b>Unit 5: Morphology of Microorganisms</b>	<b>10 hrs</b>
<ul style="list-style-type: none"> <li>• Size, Shape and Arrangement of Bacteria</li> <li>• The cell wall of Bacteria – Structure and chemical composition of Gram negative and Gram positive Bacteria</li> <li>• Bacterial Structures – Internal to Cell Wall – Cell Membrane, Protoplast, Spheroplast, Membranous intrusions and intracellular membrane system, Cytoplasm, Cytoplasmic inclusions and Vacuoles, Nuclear Material</li> <li>• Bacterial Structures – External to Cell Wall – Capsule, Flagella, Pilli, Prostheca, Sheath &amp; Stalk</li> <li>• Bacterial Spores &amp; Cyst – Types of Spore, Structure and formation of Endospores (Sporogenesis) , Occurrence &amp; Functions of Akinetes &amp; Heterocyst</li> </ul>	

**Text Books:**

- Pelczar, M.J., Chan, E.C.S., Krieg, N.R. (1993). Microbiology, 5<sup>th</sup> Edition. New Delhi: Tata McGraw Hill Publishing Company Ltd.
- Prescott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology, 5<sup>th</sup> Edition, New York: WCB McGraw-Hill publication.

**Reference Books:**

- Pommerville, J.C. (2013). Alcamo's Fundamentals of Microbiology, 10<sup>th</sup> Edition: Jones and Barlett learning LLC.
- Black, J.G. (2005). Microbiology: Principles and Explorations. New York: Wiley publication
- Tortora, G.J., Funke, B.R., Case, C.L. (2004). Microbiology: An Introduction. Singapore: Pearson Education.
- Singh, R.P. (2007). General Microbiology. New Delhi: Kalyani Publishers.

**Pedagogic tools:**

- Chalk and Board
- PPT and Videos.
- Assignment
- Class Activity: Think-Pair-Share / Class Test

**Suggested reading / E-resources**

- Bacterial Growth Curve Protocol | Protocols | Microbe Notes

- NPTEL :: Biotechnology - Microbiology
- 9: Microbial Growth - Biology LibreTexts
- Lecture notes, lecture 1 - Micro Chapter The microbial world The microbes - StuDocu

### Suggested MOOCs

- General Microbiology - Course (swayam2.ac.in)
- Food Microbiology and Food Safety - Course (swayam2.ac.in)

### Methods of assessing the course outcomes

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	1 <sup>st</sup> & 2 <sup>nd</sup> Units	1 <sup>1/2</sup> hours	30	05
	Test 2	Units 3,4,5	3 hours	70	15
B	Assignment-1	Any topic from the syllabus	By the end of 8 <sup>th</sup> week	20	05
C	Assignment-2	Any topic from the syllabus	Before 2 <sup>nd</sup> CIA	20	05
<b>Grand Total</b>					<b>30</b>

**Note: Any other assessment tools or methods can be adopted as per requirement of the course**

Course Code	Course Title (F)	Credits
23UMBCC102	Core Practical - 1: Basic Microbial Techniques	2 Credits

**Course Description:**

This course covers the study of basic skills in the subject of Microbiology This course is segregated into different experiments as per their evolution from the very basic to slightly advanced one. Techniques of isolation and purification of bacterial culture and preservation

**Course Purpose:**

This course aims to provide basic understanding of microbial techniques and instrument operation to the students. The course is designed in such a way that learners will be able to understand the Good laboratory practices, basic instrumentation needed for the conduction of experiments in a Microbiology laboratory, simple techniques of observation and study of microbial morphology and cellular structure, methods of microbial control, etc. in detail. This course will make students skilful in isolating and purifying a bacterial culture, measuring microbial growth and interpret cultural characteristics and growth pattern of different microbes. Further it will also facilitate students to understand which method to choose for effective control of microbial growth.

of microbial culture along with the operation and use of basic instruments will help students to carry out advanced practical in the next semesters.

**Course Outcomes:** Upon completion of this course, the learner will be able to

CO No.	Course Outcomes Statement	Blooms taxonomy Level(S <sub>1</sub> to S <sub>6</sub> )
CO <sub>1</sub>	Understand the operation of various basic instruments in a Microbiology Laboratory	S1
CO <sub>2</sub>	Comprehend principle and procedure of various types of staining techniques	S1
CO <sub>3</sub>	Analyse growth requirement and media selection for isolating specific microbes	S1
CO <sub>4</sub>	Learn & Apply techniques of microbial isolation, purification and growth measurement	S3
CO <sub>5</sub>	Learn & apply the methods of microbial control	S2

Sr. No.	Experiment
1	Good microbiological Laboratory Practices
2	Principles of Laboratory Sanitation
3	Principles, working and uses of the following laboratory instruments : a) Microscope b) Incubator c) pH meter d) Refrigerator e) Colorimeter
4	Principles, working and uses of the following sterilizers: a) Autoclave b) Hot air oven c) Bacteriological filters.
5	Preparation of glassware for sterilization and disposal of laboratory media & cultures.
6	Preparation of Stains and Staining Reagents.
7	Preparation of Culture media used in Microbiology Laboratory
8	Study of Permanent Slides: Bacteria, Fungi, Algae, Protozoa,
9	Study of bacterial motility by hanging drop method.
10	Monochrome Staining: a) Negative Staining b) Positive Staining
11	Gram's Staining
12	Special staining of bacteria: a) Capsule staining – Hiss's method b) Cell wall staining – Webb's method c) Spore staining – Schaeffer's method d) Metachromatic granule staining – Albert's method e) Spirochete staining – Harrie's method

### Reference Books:

- Patel. R.J., Patel. K.R. (2009). Experimental Microbiology, Vol-I, Ahmedabad: Aditya Publications.
- Patel. R.J., Patel. K.R. (2009). Experimental Microbiology, Vol-II, Ahmedabad: Aditya Publications.
- Dubey, R.C., Maheshwari, D.K. (2005). Practical Microbiology. New Delhi: S. Chand & Company Limited.
- Sharma, K. (2005). Manual of Microbiology – Tools and Techniques. New Delhi: Ane books.
- Benson, H.J. (2002). Microbiological Applications – Laboratory Manual in General Microbiology – 8<sup>th</sup> edition: MacGrow Hill Company.

**Pedagogic tools:**

- Chalk and Board
- Power point presentation
- Video

**Methods of Assessment & Tools:**

Components of CIE: 40 marks