



**SarvodayaKelavaniSamaj Managed**  
**ShreeManibhaiVirani & Smt.NavalbenViraniScienceCollege, Rajkot**  
**(Autonomous)**  
**Affiliated to SaurashtraUniversity, 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**  
**Of**  
**B. Sc. MICROBIOLOGY**  
**(W.e.f June 2021)**

**Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot  
(Autonomous)**

**Affiliated to Saurashtra University, Rajkot**

**Department of Microbiology**

**B. Sc. MICROBIOLOGY**

**Regulations for Students Admitted From A.Y. 2021-2022& 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. Microbiology must have passed examination of Diploma in Pharmacy or relevant subjects will be eligible for admission. A result of this type of candidate will be declared by considering his/her marks of semester 3 to 6 in aggregate and accordingly class will be awarded.

**DURATION OF THE PROGRAMME**

The Program

1. Shall extend over a period of three years comprising of six semesters for lateral entrants
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) 2-3 hours instruction of Tutorial   | = 1 Credit |
| c) 2-3 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 60 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 40 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

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**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 center 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**

1. Scientific knowledge: To utilize the deep discipline knowledge for practical application of socio-economical development
2. Ability of critical analysis: Apply the critical ability in identification of key global and local problems through a scientific approach
3. Development of solution: To suggest and plan solution through research and development for agricultural and healthcare problems in wellbeing of humankind keeping the safety concern in mind.
4. Modern tool uses: Ability to choose and conception of appropriate tools and techniques to address the existing problems for further development of quality life considering its limitation
5. Environment and sustainability: Ability to critically analyze and address the solution in context of environment and ability to express sustainable utilization

## **PROGRAM OUTCOMES**

**PO 1:** Ability to identify beneficial and harmful microbes and their role in science and Society

**PO 2:** To independently be able to practice skills of microbiology in day to day life

**PO 3:** Acquire skills of identifying troubleshoots and reach logical solutions by data analytics and learn to verify and record data

**PO 4:** Able to understand correlations of different physicochemical phenomenon among macro, micro life with nature

**PO 5:** Able to pursue lifelong learning by In depth understanding of fundamental and few applied aspects of microbiology

**PO 6:** Analysis of scientific issues across the spectrum of related disciplines

**PO 7:** Able to develop communicative skills and reasoning of defense

**PO 8:** Able to assist in Quality control and Quality Assurance process

**PO 9:** Acquire skills of team leading, working with peers in coordination, and adopt the nature of commitment for fulfilling task

**PO 10:** Capacitate to expand the essence of awareness of microbiology to society

**PO 11:** Develop behavioral up-liftment through inculcation of moral values, logical clarity of sense of aesthetics and ethical considerations

**PO 12:** Capable for clinical samples collection, primary identification and analysis.

## **PROGRAM EDUCATIONS OBJECTIVES**

- PEO 1: Preparation:** To prepare the students ready for industry, academics or entrepreneur ship.
- PEO 2: Core competence:** Students should be felicitated with sound theory and practical aspects of microbiology and be nurtured to thronged upon core or allied research or pursue higherstudies
- PEO 3: Breadth:** To build in depth clarity of reasoning in theoretical and practicalknowledge
- PEO 4: Professionalism:** Communicative, team leading capacity, multifaceted task solver, outreach the product or active engagement form lab toland
- PEO 5: Learning environment:** To capacitate with lifelong learning of microbiological skills and techniques, ethic and behavioralwellness

## **PROGRAMME SPECIFIC OUTCOME (PSOs) FOR B.Sc. MICROBIOLOGY PROGRAMME**

After completion of the programme the Graduate will:

- PSO 1:** Be able to apply knowledge of microbiology for research, industrial applications and clinical assistance.
- PSO 2:** Be able to apply the acquired skills specific to microbiology and allied fields for converting information to knowledge through hypothesis, design, execution and analysis
- PSO 3:** Be enable to understand microbiology as a social endeavour in context to bringing about harmony with nature

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**SCHEME OF LEARNING AND EVALUATION**

**For the students admitted from the A.Y. 2021-22 & onwards**

<b>Semester-I</b>									
<b>Course Code</b>	<b>Course</b>	<b>Contact Hrs/wk</b>			<b>SEE Duration hrs</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</b>									
21ULCEN101	English-I – Development of Functional English	3	-	-	3	40	60	100	3
	<b>Part-I Total</b>	<b>3</b>	<b>0</b>	<b>0</b>		<b>40</b>	<b>60</b>	<b>100</b>	<b>3</b>
<b>Part-II</b>									
21UMBCC101	<b>Core1: Fundamentals of Microbiology (F1)</b>	4	-	-	3	30	70	100	4
21UMBCC102	<b>Core2: Microbial Growth and Control (F2)</b>	4	-	-	3	30	70	100	4
21UMBID101	<b>IDC-1: Zoology-1 Systematics and Anatomy</b>	3	-	-	3	30	70	100	3
21UMBCC103	<b>Core Practical-1 Basic Microbial Techniques</b>	-	-	6	6#	40	60	100	4
21UMBID102	<b>IDC- Practical - 1: Zoology-1: Systematics and Anatomy</b>	-	-	6	3	40	60	100	2
<No course code>	<b>Core Enrichment – 1: Concept to Practice Course</b>		1	-	-	20	Evaluation at the end of Semester - IV		
	<b>Part-II Total</b>	<b>11</b>	<b>1</b>	<b>12</b>		<b>170</b>	<b>330</b>	<b>500</b>	<b>17</b>
<b>Part-III: Ability Enhancement Courses</b>									
21xxx	<b>AECC I: Introduction to SDG (online course)</b>	-	-	-	-	100	-	Remarks	Audit course
<No course code>	<b>AECC II: Environmental Conservation and Sustainable Development</b>	1	-	-	-	Evaluation at the end of 2 <sup>nd</sup> Semester			-

<No course code>	AECC III: Human Values for Holistic Living	1	-	2*	-	Evaluation at the end of 2 <sup>nd</sup> Semester			-
	<b>Part-III Total</b>	<b>2</b>	<b>-</b>	<b>-</b>		<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>
	<b>Total (Part-I to Part-III)</b>	<b>16</b>	<b>1</b>	<b>12</b>	<b>-</b>	<b>310</b>	<b>390</b>	<b>700</b>	<b>20</b>
		<b>29</b>				<b>700</b>			

3hrs on day1 and 3 hrson day 2; \*out of working hours



Semester-II									
Course Code	Course	Contact Hrs/wk			SEEDurationhrs	Maximum Marks			Credits
		T	Tu	P		CIA	SE E	Total	
<b>Part -I</b>									
	English II –	3	-	-	3	40	60	100	3
	<b>Part-I Total</b>	<b>3</b>	<b>0</b>	<b>0</b>		<b>40</b>	<b>60</b>	<b>100</b>	<b>3</b>
<b>Part-II</b>									
21UMBCC201	<b>Core3:</b>	4	-	-	3	30	70	100	4
21UMBCC202	<b>Core 4:</b>	4	-	-	3	30	70	100	4
21UMBCC203	<b>Core 5:</b>	4	-	-	3	30	70	100	4
	<b>IDC-2:</b>	3	-		3	30	70	100	3
21UMBCC204	<b>Core Practical - 2</b>	-	-	6	6#	40	60	100	2
	<b>IDC-2: Practical:</b>	-	-	6	3	40	60	100	2
<No course code>	<b>Core Enrichment – 1: Concept to Practice Course</b>		1		-	20	Evaluation at the end of Semester - IV		
	<b>Part-II Total</b>	<b>15</b>	<b>1</b>	<b>12</b>		<b>200</b>	<b>400</b>	<b>600</b>	<b>19</b>
<b>Part-III: Ability Enhancement Courses</b>									
21xxx	<b>AECC II:</b> Environmental Conservation and Sustainable Development	1	-	-	-	Remarks			2
21xxxx	<b>AECC III:</b> Human Values for Holistic Living	1	-	2*	-	Remarks			3
	<b>Part-III Total</b>	<b>2</b>	<b>-</b>	<b>-</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>5</b>
	<b>Total (Part-I to Part-III)</b>	<b>20</b>	<b>1</b>	<b>12</b>	<b>-</b>	<b>240</b>	<b>460</b>	<b>700</b>	<b>27</b>
		<b>33</b>				<b>700</b>			

# 3hours day 1 and Day 2; \*out of working hours

Minimum one month internship pertaining to learning for concept to practice/prototype or product development for start-up/mini and final semester project/skilling in the summer vacation/combination of semester break and summer vacation in industry/premier research institute/NGO, etc.

Semester-III									
CourseCode	Course	Contact Hrs/wk			SEED uration hrs	Maximum Marks			Credits
		T	Tu	P		CIA	SEE	Total	
<b>Part – I</b>									
	English III –	3	-	-	3	40	60	100	3
	<b>Part-I Total</b>	<b>3</b>	<b>0</b>	<b>0</b>		<b>40</b>	<b>60</b>	<b>100</b>	<b>3</b>
<b>Part-II</b>									
21UMBCC301	<b>Core6:</b>	4	-	-	3	30	70	100	4
21UMBCC302	<b>Core7:</b>	4	-		3	30	70	100	4
21UMBCC303	<b>Core8:</b>	4	-		3	30	70	100	4
	<b>DSE 1: Zoology-2:</b>	3	-	-	3	30	70	100	3
21UMBCC304	<b>Core practical – 3 –</b>	-	-	6	6	40	60	100	2
	<b>DSE 1: Practical</b>	-	-	6	3	40	60	100	2
<No course code>	<b>Core Enrichment – 1: Concept to Practice Course</b>		1	-	-	20	Evaluation at the end of Semester - IV		
	<b>Core Enrichment 2: Internship 1</b>	-	-	-		100		100	1
	<b>Part-II Total</b>	<b>15</b>	<b>1</b>	<b>12</b>		<b>300</b>	<b>400</b>	<b>700</b>	<b>20</b>
<b>Part-III: Ability Enhancement Courses</b>									
	<b>FS 3: Placement Training</b>	-	2	-					Audit course
	<b>Part-III Total</b>	-	2	-		0	0	0	
	<b>Total (Part-I to Part-III)</b>	<b>18</b>	<b>3</b>	<b>12</b>	<b>-</b>	<b>340</b>	<b>460</b>	<b>800</b>	<b>23</b>
		<b>33</b>				<b>800</b>			

Semester– IV									
CourseCode	Course	Contact Hrs/wk			SEED uratio nhrs	Maximum Marks			Credits
		T	T u	P		CIA	SEE	Total	
<b>Part – I</b>									
	English IV –	3	-	-	3	40	60	100	3
	<b>Part-I Total</b>	<b>3</b>	<b>0</b>	<b>0</b>		<b>40</b>	<b>60</b>	<b>100</b>	<b>3</b>
<b>Part–II</b>									
21UMBCC401	<b>Core 9:</b>	4	-	-	3	30	70	100	4
21UMBCC202	<b>Core10:</b>	4	-		3	30	70	100	4
	<b>Core elective 1:&lt;1&gt; &lt;2&gt;</b>	4	-		3	30	70	100	4
	<b>TDE 1</b>	2	-	-	3	30	70	100	2
	<b>DSE:2 –</b>	3	-	-	3	30	70	100	3
	<b>Core Practical – 4 –</b>			6	6	40	60	100	3
21UMBCC403	<b>Core elective Practical</b>			4	3	40	60	100	2
	<b>DSE:2 - Practical</b>			6	3	40	60	100	2
21xxxx	<b>Core Enrichment – 1: Concept to Practice Course</b>		1	-	-	40	-	100	-
	<b>Part-II Total</b>	<b>17</b>	<b>1</b>	<b>18</b>		<b>270</b>	<b>530</b>	<b>800</b>	<b>24</b>
<b>Part-III:AbilityEnhancementCourses</b>									
<no subject code>	<b>FS 3: Placement Training</b>	-	2	-					Audit course
	<b>Part-III Total</b>	<b>0</b>	<b>2</b>	<b>0</b>					
	<b>Total (Part-I to Part-III)</b>	<b>20</b>	<b>3</b>	<b>18</b>	<b>-</b>	<b>310</b>	<b>590</b>	<b>900</b>	<b>27</b>
		<b>37</b>				<b>900</b>			

Minimum one month internship pertaining to learning for concept to practice/prototype or product

development for start-up/mini and final semester project/skilling in the summer vacation/combination of semester break and summer vacation in industry/premier research institute/NGO etc.

Semester– V									
CourseCode	Course	Contact Hrs/wk			SEED uratio nhrs	Maximum Marks			Credits
		T	T u	P		CIA	SEE	Total	
<b>Part–II</b>									
21UMBCC501	<b>Core11:</b>	4	-	-	3	30	70	100	4
21UMBCC502	<b>Core12:</b>	4	-	-	3	30	70	100	4
21UMBCC503	<b>Core 13: (Self-study) –</b>	1	-	-	3	30	70	100	4
21UMBCC504	<b>Core 14 : Concept Recapitulation Test ( CRT ) for Core Courses of Semester I to V</b>				2	100	-	100	1
	<b>Core elective 2: &lt;1&gt;&lt;2&gt;</b>	4	-		3	30	70	100	4
	<b>TDE 2:</b>	2	-	-	3	30	70	100	2
21UMBCC505	<b>Core Practical – 5 -</b>			9	6	40	60	100	3
	<b>Core Elective Practical</b>			4	3	40	60	100	2
	<b>Core Enrichment 3: Internship 2</b>	-	-	-		100		100	1
	<b>Core Enrichment 4: Mini Project /Skill Enhancement</b>	-	2	4	-	100	-	100	4
	<b>Part-II Total</b>	<b>15</b>	<b>2</b>	<b>17</b>		<b>530</b>	<b>470</b>	<b>1000</b>	<b>29</b>
<b>Part-III: Ability Enhancement Courses</b>									
<no subject code>	<b>FS</b>	-	2	-		Remarks			Audit course
	<b>Part-III Total</b>	<b>0</b>	<b>2</b>	<b>-</b>		<b>0</b>	<b>0</b>	<b>0</b>	
	<b>Total (Part-II to Part-III)</b>	<b>15</b>	<b>4</b>	<b>17</b>	<b>-</b>	<b>530</b>	<b>470</b>	<b>1000</b>	<b>29</b>
		<b>34</b>				<b>1000</b>			

<b>Semester-VI</b>									
<b>Course Code</b>	<b>Course</b>	<b>Contact Hrs/wk</b>			<b>SEED uratio nhrs</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-II(Project + a Compulsory course/ Advanced Courses + a Compulsory course)</b>									
	<b>Core15: (Compulsory course)</b>	5	-	-	3	30	70	100	5
	<b>Core16:</b>	5	-	-	3	30	70	100	5
	<b>Core – 17:</b>	5	-	-	3	30	70	100	5
	<b>Core Practical – 6 – Skill Training / Start up</b>	-	-	9	6	40	60	100	4
	<b>Core Enrichment 5: Project / Dissertation</b>	-	-	20				300	14
		<b>24/25</b>						<b>400</b>	<b>19</b>
	<b>Part-II Total</b>							<b>400</b>	<b>19</b>
<b>Total Marks:400</b>									

**It is expected that student should spend \*4hrs eachdayfor6 days**

### Formation of Part-III

Course Code	Semester	Course / Component	Contact Hrs	No. of Courses	Credit/ Course	Total Credits
<b>A. Ability Enhancement Course (AEC)</b>						
<b>(i) Ability Enhancement Compulsory Course (AECC)</b>						
	I	<b>AECCI</b> :Introduction to SDG (online course)	-	1	Remarks	Audit Course
	I & II	<b>AECC II:</b> Environmental Conservation and Sustainable Development	1 Hr / Week / Semester	1	1+1	2
	I & II	<b>AECC III:</b> Human Values for Holistic Living	1 T + 2 Tu /Week /Semester	1	1+1+1	3
					<b>Sub Total</b>	<b>5 + Audit course</b>
<b>(ii) Skill Enhancement Course (SEC)</b>						
As per common list	Any Semester between II –V/VII	<b>SEC-I</b> *Value Added Courses	40 Hrs	1	1	1
	Any Semester between III –	<b>SEC-II</b> **Co- Curricular Course	80 to 120 Hrs	1	2	2



	V/VII					
					<b>Sub Total</b>	3
<b>B. Finishing School</b>						
<b>FS I to FS IV Compulsory to Earn Degree.</b>						
	I	<b>FS I:</b> Student Induction Program	3 weeks Phase 1, Phase 2, Phase 3	-	Remark	Audit course
	Across I & II Semester s	<b>FS II:</b> Fundamentals of Design Thinking (Online/Offline)	40 to 60 Hrs	1	Remark	Audit course
	Semester s I to V / VII	<b>FS III:</b> Placement training	2 Hrs / Week /Semester	As per syllabus	Remarks	Audit course
	Semester V (3 yrs program) Semester VI (4 yrs program)	<b>FS IV:</b> Community Engagement	Twice a month	1	Remarks	Audit course
<b>FS V to FS VIII Options for Advanced Learners</b>						
	Any semester from II to V/VII	<b>FS V:</b> Indian & Foreign Languages	-	Any number of courses	Remarks	Audit course
	Any semester from II to	<b>FS VI:</b> Any number of Online	-	Any number of courses	Remarks	Credit as per provider/

	V/VII	course(s) from select MOOC platforms				audit course
	Any semester from III to V/VII	<b>FS VII:</b> Advanced Design Thinking	-	1	Remarks	Audit course
	Any semester from I to VI/VIII	<b>FS VIII:</b> <b>#Extra Credit Course</b> Any number of courses from any UG program across the University	Self study	Any number of courses	As per course offered	As per credit(s) earned across all courses opted
					<b>Grand Total</b>	

**\*Value Added Courses** - Option to student to choose at least 1 from a list of courses offered by any department across the University.

**\*\*Co-Curricular Courses** - Option to students to choose 1 from a list of courses offered by any department across the University.

# Student may opt for any course of the odd/even prevailing semester from any UG program across the University with the following guidelines:

- a. Attending class not mandatory.
- b. May be mentored by the course teacher.
- c. Preparation through self-study.
- d. CIA not mandatory; evaluated for total marks at the end of the semester.
- e. Indicates options to appear for the course through examination application and payment of examination fees of that course.
- f. Credits earned through each course indicated in the consolidated mark sheet as extra credits; not included for CGPA, percentage marks and classification.

**TOTAL MARKS & CREDIT DISTRIBUTION TO EARN THE DEGREE**

<b>S. No</b>	<b>PART</b>	<b>Total Marks</b>	<b>Total Credits</b>
1.	<b>PART I:</b> Language Course	400	12
2.	<b>PART II:</b> Core, IDC, DSE, TDE	4000	128
3.	<b>PART III:</b> AECC-I, II & III SEC- I & II FS I, II, III & IV	100	08
4			Audit Courses
<b>TOTAL</b>		<b>4500</b>	<b>148</b>

**VALUE ADDED COURSES (VAC) COURSES OFFERED BY THE DEPARTMENT**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Duration</b>	<b>Credits</b>
<b>1</b>			40 Hrs	1
<b>2</b>			40 Hrs	1

**CO-CURRICULAR COURSES (CoC) COURSES OFFERED BY THE DEPARTMENT**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Duration</b>	<b>Credits</b>
<b>1</b>			80 Hrs	<b>2</b>

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

<b>Course Code</b>	<b>Course Title (F)</b>	<b>Credits</b>
<b>21UMBCC101</b>	<b>Core 1: Fundamentals of Microbiology (F)</b>	<b>4 Credits</b>

**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.
5. 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		
<b>CO No.</b>	<b>CO Statement</b>	<b>Blooms taxonomy Level (K1 to K4)</b>
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> <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> </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, Pili, 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., Kreig, 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 McGrawHill publication.

**Reference Books:**

1. Pommerville, J.C. (2013). Alcamo's Fundamentals of Microbiology, 10<sup>th</sup> Edition: Jones and Barlett learning LLC.
2. Black, J.G. (2005). Microbiology: Principles and Explorations. New York: Wiley publication
3. 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

**Text Books:**

- Pelczar, M.J., Chan, E.C.S., Kreig, N.R. (2001). Microbiology, 5<sup>th</sup> Edition. New Delhi: Tata McGraw Hill Publishing Company Ltd.
- Roger, Stanier Y., John, Ingraham, L., Mark, Weelis, L., and Page, Painter, R. (2013). General Microbiology, 5<sup>th</sup> Edition, MacMillan Press Ltd.
- General Microbiology Vol I and II –Pawar and Daginawala.

**Reference Books:**

5. Prescott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology, 5<sup>th</sup> Edition, New York: WCB McGrawHill publication.
6. Pommerville, J.C. (2013). Alcamo's Fundamentals of Microbiology, 10<sup>th</sup> Edition: Jones and Barlett learning LLC.
7. Black, J.G. (2005). Microbiology: Principles and Explorations. New York: Wiley publication
8. Tortora, G.J., Funke, B.R., Case, C.L. (2004). Microbiology: An Introduction. Singapore: Pearson Education.
9. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.

**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>



Course Code	Course Title (F)	Credits
21UMBCC102	<b>Core 2: Microbial Growth and Control (F 2)</b>	4 Credits

**Course Description:**

This course covers study of microbial growth and its control by different ways. This course is segregated into different units elucidating Growth curve, Nutritional requirement and physical parameters for microbial growth, growth measurement, Techniques of isolation and purification of bacterial culture and preservation of microbial culture. Furthermore, the course emphasizes on control of microbes by physical method, chemical method and antibiotics.

**Course Purpose:**

This course aims to provide basic understanding of microbial growth and how to control it. This is designed in such a way that learners will be able to understand Growth characteristics of different microbes; Specific requirement of nutrition, chemicals and physical condition; and control of microbes by antibiotics, chemicals and physical methods. This course will make students skillful 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.

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

CO No.	Course Outcomes Statement	Blooms taxonomy Level(K <sub>1</sub> to K <sub>6</sub> )
CO <sub>1</sub>	Explain & analyze microbial growth, their types and requirement	K2
CO <sub>2</sub>	Comprehend various phases of growth cycle	K1
CO <sub>3</sub>	Analyze growth requirement and media selection for isolating specific microbes	K1
CO <sub>4</sub>	Learn & Apply techniques of microbial isolation, purification and growth measurement	K3
CO <sub>5</sub>	Learn & apply the methods of microbial control	K2

<b>Course Content</b>	<b>Hours</b>
<b>Unit-I: Microbial Growth and Nutrition</b>	<b>12 hrs</b>
<ul style="list-style-type: none"> <li>• Introduction and Definition of Growth, Modes of Cell division in procaryotes</li> <li>• Septum Formation</li> <li>• Bacterial Growth Curve</li> <li>• Synchronous culture &amp; Continuous Growth of Bacteria</li> <li>• Measurement of Bacterial Growth</li> </ul>	
<b>Unit-II: Microbial cultivation and Pure Culture Techniques</b>	<b>12 hrs</b>
<ul style="list-style-type: none"> <li>• Types of bacteria based on nutritional requirements</li> <li>• Chemical and Physical requirement of Growth- Bacteriological Media, Air, pH &amp; Temperature</li> <li>• Cultivation of Anaerobes</li> <li>• Natural Microbial Population (Mixed Cultures), Selective methods to obtain Pure Cultures</li> <li>• Isolation, purification and Cultural Characteristics</li> <li>• Preservation of pure cultures</li> </ul>	
<b>Unit-III: Control of Microbes by Physical methods</b>	<b>12 hrs</b>
<ul style="list-style-type: none"> <li>• Definitions: Sanitization, Antisepsis, Sterilization, Disinfection, Microbiocidal&amp;Microbiostasis, Thermal Death Time, Thermal Death Point, z-Value &amp; F-value, D-Value</li> <li>• Control by Temperature: <ul style="list-style-type: none"> <li>➤ High Temperature <ul style="list-style-type: none"> <li>✓ Moist Heat – Autoclave, Boiling, Pasteurization, Fractional Sterilization</li> <li>✓ Dry Heat – Hot Air Oven, Incineration,</li> </ul> </li> <li>➤ Control by Desiccation</li> <li>➤ Control by Low Temperature</li> </ul> </li> <li>• Control by Surface tension &amp; Interfacial tension</li> <li>• Control by Radiation – UV radiation, x-rays, Gamma rays and Cathode rays</li> <li>• Control by Filtration</li> </ul>	
<b>Unit-IV: Control of Microbes by Chemical methods</b>	<b>12 hrs</b>
<ul style="list-style-type: none"> <li>• Characteristics of an Ideal Antimicrobial agent</li> <li>• Halogens – Iodine &amp; Chlorine, Heavy Metals &amp; Dyes</li> <li>• Phenol &amp; Phenolic compounds, Alcohols</li> <li>• Phenol coefficient method</li> <li>• Detergents &amp; Quaternary Ammonium Compounds, Aldehydes &amp; Gaseous agents</li> </ul>	
<b>Unit- V: Control of Microbes by Antibiotics</b>	<b>12 hrs</b>
<ul style="list-style-type: none"> <li>• Chemotherapeutic agents and Chemotherapy, Characteristics of ideal chemotherapeutic agent</li> <li>• Antibiotics and their mode of action: Inhibition Effect on cell wall</li> </ul>	

synthesis, nucleic acid and protein synthesis, Damage to cytoplasmic membrane, Inhibition of specific enzyme system • Nonmedical uses of antibiotics • Antifungal, antiviral and antitumor chemotherapeutic agents • Microbiological assay of antibiotics	
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**Text books:**

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi. (UNIT: 1 & 2)
2. Powar, C.B., Daginawala, J.F. (2010). General Microbiology Vol-I. Mumbai: Himalaya Publishing House. (UNIT: 3,4 &5)

**Reference books:**

1. Stanier, R.Y. (1987). General Microbiology, 5<sup>th</sup> Edition: Macmillan publication.

**Pedagogic tools:**

- Chalk and Board
- Power point presentation
- Video
- Seminars

**Methods of Assessment & Tools:**

Components of CIE: 30 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
<b>A</b>	Test 1	1 <sup>st</sup> 2 units	1 <sup>1/2</sup> hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 70)	
<b>B</b>	Assignment			04	10
<b>C</b>	Class activity			06	
<b>Grand Total</b>					<b>30</b>
<b>Assignment</b>		<ul style="list-style-type: none"> <li>• Power point presentation of given topic</li> <li>• Chart preparation</li> </ul>			
<b>Class activity</b>		<ul style="list-style-type: none"> <li>• Quiz</li> <li>• Class Test</li> <li>• Seminars</li> <li>• Group Discussion</li> </ul>			

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

Course Code	Course Title (F)	Credits
21UMBCC103	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 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 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.

**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	S <sub>1</sub>
CO <sub>2</sub>	Comprehend principle and procedure of various types of staining techniques	S <sub>1</sub>
CO <sub>3</sub>	Analyse growth requirement and media selection for isolating specific microbes	S <sub>1</sub>
CO <sub>4</sub>	Learn & Apply techniques of microbial isolation, purification and growth measurement	S <sub>3</sub>
CO <sub>5</sub>	Learn & apply the methods of microbial control	S <sub>2</sub>

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
13	Measurement of size of microorganisms by Micrometry (Demonstration)
14	Calibrations of microscopic measurements (Ocular & stage micrometers)
15	Isolation of microorganisms by various methods
16	Turbidometric study of growth curve of <i>E.coli</i> and derivation of Growth rate & Generation time.
17	Enumeration of bacteria by viable count technique.
18	Enumeration of bacteria by Total Count Technique.
19	Effect of various chemicals on microbial growth
20	Effect of antibiotics on microbial growth

### Reference Books:

1. Patel. R.J., Patel. K.R. (2009). Experimental Microbiology, Vol-I, Ahmedabad: Aditya Publications.
2. Patel. R.J., Patel. K.R. (2009). Experimental Microbiology, Vol-II, Ahmedabad: Aditya Publications.
3. Dubey, R.C., Maheshwari, D.K. (2005). Practical Microbiology. New Delhi: S. Chand & Company Limited.
4. Sharma, K. (2005). Manual of Microbiology – Tools and Techniques. New Delhi: Ane books.
5. 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

<b>Sr. No.</b>	<b>Component</b>	<b>Content</b>	<b>Duration (if any)</b>	<b>Marks</b>	<b>Sub Total</b>
<b>A</b>	Test	After the completion of 60-70% of the performance practical	6 hrs ( 3 hrs on Day – 1 and 3 hrs on Day – 2)	30	30
<b>B</b>	Laboratory book and Journal	-	-	10	10
<b>Grand Total</b>					<b>40</b>