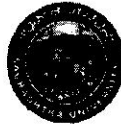




वसुधैव कुटुम्बकम्
ONE EARTH • ONE FAMILY • ONE FUTURE



SAURASHTRA UNIVERSITY

Academic Section

University Campus, University Road,
Rajkot - 360005

Phone No.: (0281) 2578501 Ext. No. 202 & 304
FAX No.: (0281) 2576347 E-mail Id: academic@sauuni.ac.in



નં.એકે/વિજ્ઞાન/ (૧૧૦૪) /૨૦૨૩

તા.૨૮/૦૭/૨૦૨૩

માઈકોબાયોલોજી

પરિપત્ર:-

આથી સૌરાષ્ટ્ર યુનિવર્સિટીની વિજ્ઞાન વિદ્યાશાખા હેઠળ સ્નાતક કક્ષાનાં B.Sc. (માઈકોબાયોલોજી) નાં અભ્યાસક્રમ ચલાવતી સર્વે સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે, NEP-2020 અંતર્ગતનાં રાજ્ય સરકારશ્રીનાં તા.૧૧/૦૭/૨૦૨૩ નાં ઠરાવ મુજબનાં અભ્યાસક્રમો ચેરમેનશ્રી, માઈકોબાયોલોજી વિષયની અભ્યાસ સમિતિ દ્વારા રજુ કરાયેલ B.Sc. (માઈકોબાયોલોજી) સેમેસ્ટર-૦૧ અને ૦૨ નાં અભ્યાસક્રમો આગામી શૈક્ષણિક સત્ર જુન-૨૦૨૩ થી અમલમાં આવે તે રીતે માઈકોબાયોલોજી વિષયની અભ્યાસ સમિતિ, વિજ્ઞાન વિદ્યાશાખા, એકેડેમિક કાઉન્સિલ તથા સિન્ડિકેટની બહાલીની અપેક્ષાએ મંજૂર કરવા માન.કુલપતિશ્રીને ભલામણ કરેલ, જે માન.કુલપતિશ્રીએ મંજૂર કરેલ છે. જેથી સર્વે સંબંધિતોએ તે મુજબ તેનો અમલ કરવા વિનંતી.

(મુસદ્દો કુલસચિવશ્રીએ મંજૂર કરેલ છે.)

બિડાણ:- ઉક્ત અભ્યાસક્રમ (સોફ્ટ કોપી)

સહી/-

(એ.એસ.પારેખ)

કુલસચિવ

રવાના કર્યું

એકેડેમિક ઓફીસર

પ્રતિ,

- (૧) વિજ્ઞાન વિદ્યાશાખા હેઠળ માઈકોબાયોલોજી વિષય ચલાવતી સ્નાતક કક્ષાની સર્વે સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓ તરફ.
- (૨) વિજ્ઞાન વિદ્યાશાખા હેઠળની માઈકોબાયોલોજી વિષયની અભ્યાસ સમિતિનાં સર્વે સભ્યશ્રીઓ

નકલ જાણ અર્થે સાદર રવાના:-

૧. માન.કુલપતિશ્રી / કુલસચિવશ્રીનાં અંગત સચિવશ્રી

નકલ રવાના (યોગ્ય કાર્યવાહી અર્થે) :-

૧. ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા
૨. પરીક્ષા વિભાગ
૩. પી.જી.ટી.આર.વિભાગ
૪. જોડાણ વિભાગ

SAURASHTRA UNIVERSITY



COURSE STRUCTURE & SYLLABUS

FOR

BACHELOR OF SCIENCE
(Honours / Honours with Research)

4 YEARS UNDERGRADUATE ACADEMIC PROGRAMME
IN

MICROBIOLOGY



(CORE COURSE FOR SEMESTERS I & II)

(As per the guidelines of UGC & NEP-2020 - CBCS/CCFUP)

Effective from June - 2023



PREFACE

Timely revision of the curriculum to encompass new knowledge and information is a prime criterion of IQAC and a prime need for the college educational systems affiliated with Universities. Under the NEP - 2020 and UGC guidelines, a student must be offered the latest courses of varied nature with societal, environmental, and economic implications. The curriculum should offer multiple entry-exit and a choice of vast subjects to choose from to a student to facilitate his learning abilities, aptitude, and inclination.

Microbiology is a foundation subject for Agriculture, Biochemistry, Bioinformatics, Biotechnology, Environmental Science, Genetic engineering, Molecular biology, and Medical Microbiology and hence holds the central position in the curriculum of these subjects. Looking at the rapid inventions and technological developments in the field of Microbiology and keeping in view the recommendations of UGC and NEP-2020, this syllabus has been formulated by the combined and coordinated efforts of all the faculty members of all the Microbiology Departments of Colleges affiliated to Saurashtra University.

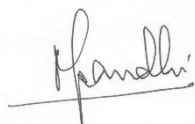
The composition of a curriculum for a particular subject requires the following criteria to be considered:

1. Guidelines and Model curriculum were given by the UGC, State Government, and the University
2. Regional needs and Present National and International trends in the subject
3. Geographical parameters of the University and its demographic property
4. Relationship with other related subjects and resources of educational needs.
5. Financial and statutory provisions of the State government

The content of a syllabus should be such that it maintains continuity with the course content of higher secondary classes and post-graduate courses. The current curriculum is made keeping this in mind and is an effort to impart fundamental knowledge of the subject needed at this level. The curriculum is designed per the guidelines of UGC and NEP-2020 and reflects the courses' total credit, teaching hours, and question paper style. The syllabus units are well-defined, and the scope of each is given in detail. A list of reference books is provided at the end of each course. Microbiology being an experimental science, sufficient emphasis is given to training and instrumentation. The following objectives have been considered while formulation the curriculum:

1. To provide an updated, feasible, and modern syllabus to the students, emphasizing knowledge and skill to build up their valuable college education and job-oriented carrier.
2. To frame the syllabus in accordance with the semester system and UGC – NEP 2020 guidelines and in consultation with all stakeholders.
3. To offer the students an array of Core, Interdisciplinary, Multidisciplinary, Skill enhancement, Ability enhancement and Value-added courses to select from and to facilitate his academic, intellectual and social grooming.

The Board of Studies for Microbiology expresses heartfelt gratitude to the Dean, Faculty of Science, Saurashtra University, for valuable guidelines and the Academic Section for much-needed cooperation. The Board wishes all the students pursuing Microbiology a very bright future.



(Dr. Neepa Dilipkumar Pandhi)
Chairman, Board of Studies, Microbiology
Saurashtra University, Rajkot (Gujarat)
Date: 20th July 2023

Saurashtra University, Rajkot

B.Sc. (Honours) / B.Sc. (Honours with Research) MICROBIOLOGY PROGRAMME Regulations for Students Admitted from A.Y. 2023-2024 & Onwards

ELIGIBILITY

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

LATERAL ENTRY

Candidates seeking admission directly in the third semester of B.Sc. / B.Sc. (Honours) Microbiology must have passed the examination of a Diploma in Pharmacy or relevant subjects to be eligible for admission.

DURATION OF THE PROGRAMME

The program shall extend over three / four years, comprising six / eight semesters for the fresh entrants. For lateral entrants, it shall be of two / three years, comprised of four / six semesters. The program comprises two semesters in one academic year, wherein each semester will usually be of 15 weeks or at least 90 teaching days.

OUTCOME-BASED EDUCATION (OBE)

The National Higher Education Qualifications Framework (NHEQF) envisages that students must possess the quality and characteristics of the Graduate of a program of study, including learning outcomes relating to the disciplinary area(s) in the chosen field(s) of learning and generic learning outcomes that are expected to be acquired by a graduate on completion of the program(s) of study. It focuses on measuring students' performance, i.e., outcomes at different levels.

STRUCTURE OF THE PROGRAMME

UG program shall have a curriculum comprising theory and practical (separate/inbuilt with theory) courses with a specified syllabus. The curriculum of the program is a blend of Major Courses, Minor (Mi)/Interdisciplinary Courses (IDC), Multidisciplinary Courses (MDC), Ability Enhancement Courses (AEC), Skill Enhancement Courses, Value Added Courses and Indian Knowledge System courses.

MEDIUM OF INSTRUCTION AND EXAMINATIONS

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

EVALUATION

The evaluation shall generally comprise Internal Assessment (IA) and External Assessment (ExA) with percentage weightage as specified below.

Components	Theory Courses	Practical Courses
Internal Assessment (CIA)	30 %	30 %
External Assessment (ExA)	70 %	70 %

GENERAL INSTRUCTIONS

- The Medium of Instruction will be English for all Theory and Practical courses.
- In a semester of 15 weeks, 1 credit = 1 lecture/week for theory courses
- Each Lecture (Period) will be 55 Mins. (1 Period = 55 Mins).
- In a semester of 15 weeks, 1 credit = 2 hours/week for practical courses
- Each Semester's Theory course will be of FIVE Units.
- There will be 45Hrs.of Major Course Theory teaching / Course/ Semester 1 and 2 and then after 60Hrs.of Major Course Theory teaching/Course/Semester 3 to 8
- There will be 45Hrs.of theory teaching / Course/ Semester for Minor courses and Multi / Inter Disciplinary course
- Each Theory course / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical course / Semester will be 50 Marks, with 15 internal and 35 external marks.

INSTRUCTIONS TO THE CANDIDATES FOR PRACTICAL EXAMINATION

- The practical examination will be conducted for TWO (2) days.
- The time duration of the practical examination will be THREE (3) hrs on both days.
- All the students must remain present at the examination center 15 minutes before the scheduled time.
- Students must carry a certified journal, I-card or examination receipt, Slide box, Apron, and all other requirements for examination.
- Candidates should not leave the laboratory without the permission of the examiner.
- The use of a calculator is allowed, but the use of Mobile phones is strictly prohibited.
- The candidate can leave the laboratory only after submitting all the answer sheets of the exercises performed to the examiner.

Saurashtra University, Rajkot
MICROBIOLOGY PROGRAMME - B.Sc. (Honours) / B.Sc. (Honours with Research)
Curriculum Framework & Syllabus for A.Y. 2023-2024 & Onwards

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 program shall enable students to understand the basics of Microbiology and its scope.
2. Students will learn about various microorganisms, their distinguishing features, characteristic properties, and their place in the world.
3. The program will impart a detailed understanding of the allied fields of Microbiology, like Cell Biology, Metabolism, Immunology, Applied microbiology, Bioprocess Technology, and Molecular Biology, to enable them to understand the emerging and advanced concepts in modern biology and help them to take up a career in this field.
4. After completing the program, the students will be able to acquire the necessary knowledge and skill in Microbiology to undertake higher studies in recognized Institutions of advanced learning and engage in gainful self-employment.
5. The program shall facilitate students to be innovative and to develop versatile personalities in the field of Life Science with quality education and can be skilled human resources required in academic research, industrial development, Institutions of Higher Learning, and Industry.

GRADUATE ATTRIBUTES

Graduates should be able to demonstrate the acquisition of the following:

- **Academic excellence:** Comprehensive knowledge and coherent understanding of Microbiology and other interdisciplinary areas of study
- **Practical, professional, and procedural knowledge** required for carrying out professional or highly skilled work/tasks related to Microbiology, including knowledge required for undertaking self-employment initiatives and knowledge and mindset required for entrepreneurship, improved product development, or a new mode of organization
- **Critical and Analytical reasoning/thinking and Effective communications:** Analysis and evaluation of information to form a judgment about a subject or idea and ability to communicate the same in a structured form.
- **Research-related skills:** the ability to understand basic research ethics and skills in practicing/doing ethics in the field/ in personal research work, regardless of the funding authority or field of study.
- **Leadership qualities and Teamwork abilities:** The graduates should be able to demonstrate the capability for mapping out the tasks of a team and setting direction and inspiring vision, and building a team that can help achieve the goals
- **Global Citizenship:** Mutual understanding with others from diverse cultures, perspectives, and backgrounds by embracing and practicing constitutional, humanistic, ethical, and moral values in life, including universal human values of truth, righteous conduct, peace, love, nonviolence, and scientific temper.
- **Life Long Learning:** Ready to imbibe new knowledge, values, and skills with an open mind and willing to adopt change for constructive development.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

This program will produce Graduates who will attain the following PEOs after a few years.

PEO 1	:	Core subject competency: will acquire the competency to pursue higher education, develop a professional career, or be self-employed with the knowledge and skills of Microbiology and allied sciences.
PEO 2	:	Application of knowledge: will show the ability to apply the knowledge of Microbiology to independently design and execute minor research problems for societal and human welfare.
PEO 3	:	Overall Preparedness: I will have the ability to undertake any assignment as a leader or team member and will be able to contribute to academics, entrepreneurship, and research, with good communication skills.
PEO 4	:	Professionalism: will possess strong professional ethics to fulfill moral duties towards his profession, community, society, and the nation.
PEO 5	:	Learning environment: will show readiness for lifelong learning to meet personal, professional, social, and global demands through knowledge and skills.

PROGRAM OUTCOMES: (POs)

After completion of the B.Sc. Microbiology program, the Graduate will be able to:

PO 1	:	Specific Disciplinary knowledge: Demonstrate an understanding of fundamental principles, scope, and applications of Microbiology and can appreciate the beneficial and harmful role of microorganisms
PO 2	:	Problem analysis: Accurately identify and critically analyze problems in various domains of Biological sciences.
PO 3	:	Designing viable solutions: Search for and successfully arrive at viable conclusions/solutions about various aspects of life sciences using the right approach and appropriate tools and techniques
PO 4	:	Scientific aptitude: Ability to solve local, regional, national, or global problems scientifically using logical thinking and advanced techniques.
PO 5	:	Modern tool usage: Understand standard operating procedures and safety measures and acquire in-depth technical competence to handle the basic laboratory instruments and retrieve scientific information with modern data search tools.
PO 6	:	Global citizen: Demonstrate the ability to understand the needs of changing world from a Microbiology perspective and with an insight into his constructive role for the societal benefits honestly and consistently with a strong sense of ethics and values.
PO 7	:	Environment and sustainability: Can be an ambassador for Environmental protection and advocate for the need to advocate for sustainable development.
PO 8	:	Ethics: Commitment to professional and social ethics and work accordingly
PO 9	:	Individual and team work: Exhibit the potential to effectively accomplish tasks as a leader or a member of a team as well as independently in multidisciplinary settings.
PO 10	:	Communication: Possess practical Communicate skills in spoken and written forms for practical idea sharing with the scientific community, society, and colleagues.
PO 11	:	Scientific Innovations and fund management: Ability to design a research project and manage its execution to generate new scientific insights, innovations, and revenues with proper time and fund management.
PO 12	:	Life-long learning: Ready to undertake life-long learning to periodically update scientific knowledge and its application.

PROGRAM SPECIFIC OUTCOMES (PSOs) for B. Sc. Microbiology program

After completion of the program, the Graduate will:	
PSO1	: Acquire sound knowledge about the fundamentals of Microbiology to develop a solid base to enable the understanding of emerging and advanced concepts in life sciences.
PSO2	: Be equipped with knowledge, skill, and inspiration to pursue higher education and research in Microbiology and allied fields to answer urgent global problems.
PSO3	: Use Microbiology principles and applications to find innovative solutions for environment, agriculture, and health-related issues at local and global levels.
PSO4	: Acquire the skill and the required knowledge to be an entrepreneur/self-employed and serve the scientific community and society by generating problem solutions and employment.
PSO5	: Become competent and eligible to appear in various competitive exams, placement in government and private sectors of academia, research, and industries, and become a successful Microbiologist serving the Nation.

Arrangement of Credit Distribution Framework for three/four years Honours/Honours with Research Degree Programme with Multiple Entry and Exits Options for all the institutions:

NCrF Credit Level	Sem-ester	Major (Core)	Minor (Electives)	Multi/ Inter-disciplinary	AEC	SEC/ Internship	VAC/ IKS	RP/ OJT	Total Credit per Sem.	Qualification /Certificate
4.5 First Year	I	8	4	4	2	2 (SEC)	2 (IKS)	-	22	UG Certificate
	II	8	4	4	2	2 (SEC)	2 (VAC)	-	22	
1 st Year Total Credits		16	8	8	4	4	4	-	44	
Exit 1: Award of UG certificate in Major course with 44 credits with additional 4 credits of Summer Internship in core specific NSQF defined course OR continue with Major and Minor course for next NCrF credit level										
5.0 Second Year	III	12	-	4	2	2 (SEC)	2 (IKS)	-	22	UG Diploma
	IV	12	4	-	2	2 (SEC)	2 (VAC)	-	22	
2 nd Year Total Credits		40	12	12	8	8	8	-	88	
Exit 2: Award of UG Diploma in Major course with 88 credits with additional 4 credits of Summer Internship in core specific NSQF defined course OR continue with Major and Minor course for next NCrF credit level										
5.5 Third Year	V	12	8	-	-	2 (SEC)	-	-	22	UG Degree
	VI	12	4	-	2	4 (Internship)	-	-	22	
3 rd Year Total Credits		64	24	12	10	14	8	-	132	
Award of UG Degree in Major course with 132 credits and Internship in core discipline OR continue with Major and Minor course for next NCrF credit level										
6.0 Fourth Year	VII	12	4	-	-	-	-	6 (OJT)	22	UG Honours Degree
	VIII	12	4	-	-	-	-	6 (OJT)	22	
4 th Year Total Credits		88	32	12	10	14	8	12	176	
Award of UG Honours Degree in Major course with total 176 credits										
6.0	VII	12	4	-	-	-	-	6 (RP)	22	UG Honour with Research Degree
	VIII	12	4	-	-	-	-	6 (RP)	22	
4 th Year Total Credits		88	32	12	10	14	8	12	176	
Award of UG Honours with Research Degree in Major course with total 176 credits										

Abbreviation:

AEC (Ability Enhancement Course); IKS (Indian Knowledge System); NCrF (National Credit Framework); NSS (National Service Scheme); NCC (National Cadet Corps); NSQF (National Skills Qualification Framework); OJT (On-the-Job Training); SEC (Skills Enhancement Course); RP (Research Project); VAC (Value Added Course), ODL (Open and Distance Learning)

Note:

- 1) Internship in 6th semester shall be in Major specific courses and credit allocated for internship would be compulsorily counted under Major course.
- 2) Honours students not undergoing research, will do either OJT in 7th and 8th semester OR 3 courses of Major/Minor of 12 credits in lieu of a research project, which will be awarded honours degree to the students.
- 3) Credit aligned with each course (Subject) in Major/Minor/Multidisciplinary is kept 04 credits.

Based on above credit framework, calculation of credits in third and fourth years shall be as below:

Year	Major (Core) (Internship credits to be added)	Minor (Electives)	Multi/Inter disciplinary	AEC	SEC	VAC/ IKS	Research Project/ On-the-Job Training	Semester wise cumulative total credits
Third	64 + 4 (internship) = 68	24	12	10	10	8	-	132
Fourth	88 + 4 (internship) = 92	32	12	10	10	8	12	176

Credit Framework for 3 years/ 4 years UG Programme

NCrF Credit Levels	Qualification Title	Credit Requirements	No. Of Semesters	Year
4.5	UG Certificate	44	2	1
5.0	UG Diploma	88	4	2
5.5	Three Year Bachelor's Degree	132	6	3
6.0	Bachelor's Degree-Honours OR Bachelor's Degree-Honours with Research	176	8	4

Curriculum Framework

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

Semester – I							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major – 1 Microbiology-1	Fundamentals of Microbiology	3	3	30	70	100
2	Major – 1 – Practical Microbiology-1	Fundamentals of Microbiology	1	2	15	35	50
3	Major – 2 Microbiology-2	Basics of Microbial Chemistry	3	3	30	70	100
4	Major – 2 – Practical Microbiology-2	Basics of Microbial Chemistry	1	2	15	35	50
5	Minor 1* Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Any One. (as per the expertise and resources available in the college)	3	3	30	70	100
6	Minor – 1 Practical * Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Practical of the Course selected as Minor	1	2	15	35	50
7	Multi/Inter Disciplinary Course – 1** – Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Any One. (as per the expertise and resources available in the college)	3	3	30	70	100
8	Multi/Inter Disciplinary Course - 1 – Practical - Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Practical of the Course selected as MDC	1	2	15	35	50
9	AECC - English – 1	English	2	2	0	50	50
10	SEC- 1	Basics of Clinical Laboratory	2	4	50	0	50
10	CVAC 1***	From the basket of IKS courses given by University	2	2	50	0	50
TOTAL CREDITS			22	28	280	470	750

* Any one course is to be selected as **Minor course** as per the expertise and resources available in the College.

** Any one course is to be selected as **Multi / Inter Disciplinary Course** as per the expertise and resources available in the College.

*** **Common Value-Added Course (CVAC)** Common to all the B.Sc Semester – I students.

Semester – II							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major – 3 Microbiology-3	Microbial Growth and Control	3	3	30	70	100
2	Major – 3 – Practical Microbiology-3	Microbial Growth and Control	1	2	15	35	50
3	Major – 4 Microbiology-4	Microbial Taxonomy and Diversity	3	3	30	70	100
4	Major – 4 – Practical Microbiology-4	Microbial Taxonomy and Diversity	1	2	15	35	50
5	Minor 2* Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Any One. (as per the expertise and resources available in the college)	3	3	30	70	100
6	Minor 2 – Practical * Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Practical of the Course selected as Minor	1	2	15	35	50
7	Multi/Inter Disciplinary Course – 2** – Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Any One. (as per the expertise and resources available in the college)	3	3	30	70	100
8	Multi/Inter Disciplinary Course – 2 Practical** - Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Practical of the Course selected as MDC	1	2	15	35	50
9	AECC - English – 2	English	2	2	0	50	50
10	SEC- 2	Mushroom Cultivation	2	4	50	0	50
10	CVAC 2***	From the basket of IKS courses given by University	2	2	50	0	50
TOTAL CREDITS			22	28	280	470	750

* Any one course is to be selected as **Minor course** as per the expertise and resources available in the College.

** Any one course is to be selected as **Multi / Inter Disciplinary Course** as per the expertise and resources available in the College.

*** **Common Value-Added Course (CVAC)** Common to all the B.Sc Semester – II students.

Curriculum Framework

NCrF- Level 5: Second Year FYUGP: Semester III & IV (UG Diploma in Sciences)

Semester – III							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major 5 Microbiology-5	Applied Microbiology	4	4	30	70	100
2	Major 5 -Practical Microbiology-5	Applied Microbiology	2	4	15	35	50
3	Major 6 Microbiology-6	Agriculture Microbiology	4	4	30	70	100
4	Major 6 -Practical Microbiology-6	Agriculture Microbiology	2	4	15	35	50
5	Multi/Inter Disciplinary Course** - 3 – Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Any One. (as per the expertise and resources available in the college)	3	3	30	70	100
6	Multi/Inter Disciplinary Course – 3 Practical **- Biochemistry/ Biotechnology/ Botany/ Zoology/ Chemistry/ Industrial Chemistry/ Maths/ Physics/ Computer Science	Practical of the Course selected as MDC	1	2	15	35	50
8	AECC - English – 3	English	2	2	0	50	50
	SEC- 3	Vermicomposting	2	4	50	0	50
9	CVAC 3***	From the basket of IKS courses given by University	2	2	50	0	50
TOTAL CREDITS			22	29	235	365	600

** Any one course is to be selected as **Multi / Inter Disciplinary Course** as per the expertise and resources available in the College.

*** **Common Value-Added Course (CVAC)** Common to all the B.Sc Semester – I students.

Semester -IV							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major 7 Microbiology-7	Prokaryotic Metabolism	4	4	30	70	100
2	Major 7 -Practical Microbiology-7	Prokaryotic Metabolism	2	4	15	35	50
3	Major 8 Microbiology-8	Bioanalytical Techniques	4	4	30	70	100
4	Major 8 -Practical Microbiology	Bioanalytical Techniques	2	4	15	35	50
5	Minor 3* Biochemistry/ Biotechnology/ Botany/Zoology/Chemistry/Industrial Chemistry/ Maths/ Physics/ Computer Science	Any One. (as per the expertise and resources available in the college)	3	3	30	70	100
6	Minor – 3* Practical * Biochemistry/ Biotechnology/ Botany/Zoology/Chemistry/Industrial Chemistry/ Maths/ Physics/ Computer Science	Practical of the Course selected as Minor	1	2	15	35	50
7	AECC - English – 4	English	2	2	0	50	50
8	SEC- 4	Biofertilizers	2	4	50	0	50
9	CVAC 4***	From the basket of IKS courses given by University	2	2	50	0	50
TOTAL CREDITS			22	29	235	365	600

* Any one course is to be selected as **Minor course** as per the expertise and resources available in the College.

*** **Common Value-Added Course (CVAC)** Common to all the B.Sc Semester – II students.

NCRF- Level 5.5: B.Sc. Semesters V & VI (Bachelor of Sciences)

Semester - V							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major 9 Microbiology-9	Immunology	4	4	30	70	100
2	Major 9 -Practical Microbiology-9	Immunology	2	4	15	35	50
3	Major 10 Microbiology-10	Medical Microbiology	4	4	30	70	100
4	Major 10 -Practical Microbiology-10	Medical Microbiology	2	4	15	35	50
5	Core Elective-1 – Discipline Specific Elective- A/B	Fermented foods / Metabolic disorders	3	3	30	70	100
6	Core Elective-1 Practical- Discipline Specific Elective- A/B	Fermented foods / Metabolic disorders	1	2	15	35	50
7	Core Elective-2 – Discipline Specific Elective- A/B	Biodiversity studies / Plant Pathology	3	3	30	70	100
8	Core Elective-2 Practical- Discipline Specific Elective- A/B	Biodiversity Studies / Plant Pathology	1	2	15	35	50
9	SEC - 5	Hydroponics	2	4	30	70	100
TOTAL CREDITS			22	30	210	490	700

Semester - VI							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major 11 Microbiology-11	Industrial Microbiology	4	4	30	70	100
2	Major 11 -Practical Microbiology-11	Industrial Microbiology	2	4	15	35	50
3	Major 12 Microbiology-12	Molecular Biology and Genetic Engineering	4	4	30	70	100
4	Major 12 -Practical Microbiology-12	Molecular Biology and Genetic Engineering	2	4	15	35	50
7	Core Elective – 3 - Discipline Specific Elective- A/B	QAQC/ Intellectual Property Rights	3	3	30	70	100
8	Core Elective –3 Practical- Discipline Specific Elective- A/B	QAQC/ Intellectual Property Rights	1	2	15	35	50
9	AECC - English – 5	English – Communication Skills	2	2	0	50	50
10	SEC 6 – Major subject	Internship	4	8	30	70	100
TOTAL CREDITS			22	31	165	435	600

NCrF- Level 6: B.Sc. Semester VII & VIII (Bachelor of Sciences Honours/Honours with Research)

Semester - VII (Honours)							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major 13 Microbiology-13		4	4	30	70	100
2	Major 13 -Practical Microbiology-13		2	4	15	35	50
3	Major 14 Microbiology-14		4	4	30	70	100
4	Major 14 -Practical Microbiology-14		2	4	15	35	50
5	Core Elective - 4 - Discipline Specific Elective- A/B		3	3	30	70	100
6	Core Elective - 4 - Practical - Discipline Specific Elective- A/B		1	2	15	35	50
7	On -The-Job training / Training		6	12	90	210	300
TOTAL CREDITS			22	33	225	525	750

Semester - VIII (Honours)							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major 15 Microbiology-15		4	4	30	70	100
2	Major 15 -Practical Microbiology-15		2	4	15	35	50
3	Major 16 Microbiology-16		4	4	30	70	100
4	Major 16 -Practical Microbiology-16		2	4	15	35	50
5	Core Elective 5- Discipline Specific Elective- A/B		3	3	30	70	100
6	Core Elective 5- Practical - Discipline Specific Elective- A/B		1	2	15	35	50
7	On -The-Job training / Training		6	12	90	210	300
TOTAL CREDITS			22	33	225	525	750

Semester - VII (Honours with Research)							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major 13 Microbiology-13		4	4	30	70	100
2	Major 13 -Practical Microbiology-13		2	4	15	35	50
3	Major 14 Microbiology-14		4	4	30	70	100
4	Major 14 -Practical Microbiology-14		2	4	15	35	50
5	Core Elective - 4 - Discipline Specific Elective- A/B		3	3	30	70	100
6	Core Elective - 4 - Practical - Discipline Specific Elective- A/B		1	2	15	35	50
7	Research Project		6	12	90	210	300
TOTAL CREDITS			22	33	225	525	750

Semester - VIII (Honours with Research)							
Sr. No	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major 15 Microbiology-15		4	4	30	70	100
2	Major 15 -Practical Microbiology-15		2	4	15	35	50
3	Major 16 Microbiology-16		4	4	30	70	100
4	Major 16 -Practical Microbiology-16		2	4	15	35	50
5	Core Elective 5- Discipline Specific Elective- A/B		3	3	30	70	100
6	Core Elective 5- Practical - Discipline Specific Elective- A/B		1	2	15	35	50
7	Research Project		6	12	90	210	300
TOTAL CREDITS			22	33	225	525	750

C = Credit, IM = Inter Exam Marks, EM = External Exam Marks

SKELETON OF SEMESTER END THEORY EXAMINATION (EXTERNAL)

CORE COURSES

QUESTION 1 – UNIT 1		
Q 1 A	Objective type questions(4 x 1 or 2 x 2 marks)	4 Marks
Q 1 B	Answer in brief(Any 1 out of 2)	4 Marks
Q 1 C	Write a note on (Any 1 out of 2)	6 Marks
QUESTION 2 – UNIT 2		
Q 2 A	Objective type questions (4 x 1 or 2 x 2 marks)	4 Marks
Q 2 B	Answer in brief (Any 1 out of 2)	4 Marks
Q 2 C	Write a note on (Any 1 out of 2)	6 Marks
QUESTION 3– UNIT 3		
Q 3 A	Objective type questions (4 x 1 or 2 x 2 marks)	4 Marks
Q 3 B	Answer in brief (Any 1 out of 2)	4 Marks
Q 3 C	Write a note on (Any 1 out of 2)	6 Marks
QUESTION 4 – UNIT 4		
Q 4 A	Objective type questions (4 x 1 or 2 x 2 marks)	4 Marks
Q 4 B	Answer in brief (Any 1 out of 2)	4 Marks
Q 4 C	Write a note on (Any 1 out of 2)	6 Marks
QUESTION 5 – UNIT 5		
Q 5 A	Objective type questions (4 x 1 or 2 x 2 marks)	4 Marks
Q 5 B	Answer in brief (Any 1 out of 2)	4 Marks
Q 5 C	Write a note on (Any 1 out of 2)	6 Marks
TOTAL MARKS:70 TOTAL TIME: 2½ HOURS		

SKELETON OF SEMESTER END PRACTICAL EXAMINATION (EXTERNAL)

CORE COURSES

SEMESTER – I and II

SECTION- I: EXAMINER –I
(EXTERNAL)

Ex. No.	Detail of Exercise	Marks	Day to begin the exercise
1	Perform any one from the given list of exercises as per the instruction of the examiner exercise	10	1 st Day
5	Viva-voce	04	1 st / 2 nd Day
6	Certified Journal	03	1 st / 2 nd Day
Total Marks			17

SECTION- II: EXAMINER –II
(INTERNAL)

Ex. No.	Detail of Exercise	Marks	Day to begin the exercise
2	Perform any one from the given list of exercises as per the instruction of the examiner exercise	10	1 st /2 nd Day
3	Spotting	04	1 st /2 nd Day
4	Viva-voce	04	1 st / 2 nd Day
Total Marks			18

**INTERNAL EVALUATION FOR THEORY
CORE COURSES**

SEMESTER – I and II

No.	Internal Evaluation Component	Marks	Duration	Weightage
1	1 st Internal Test (after completion of 50% of the syllabus)	30	1hrs 30 mins	10 marks
2	2 nd Internal Test (after completion of the remaining 50% syllabus, syllabus covered in 1 st internal is NOT TO BE INCLUDED)	30	1hrs 30 mins	10 marks
3	Assignment	20	Before 2 nd Internal test	10 marks
TOTAL				30 marks

**INTERNAL EVALUATION FOR PRACTICAL
CORE COURSES**

SEMESTER – I and II

No.	Internal Evaluation Component	Marks
1	Practical Performance	05
2	Reagent Preparation/Calculation/ Answer specifically / Spotting	05
3	Viva	05
TOTAL		15

LIST OF INSTRUMENTS FORMICROBIOLOGY LABORATORY
SEMESTERS 1 AND 2

No.	Name of Instrument
1	Compound Microscopes
2	Autoclave
3	Incubator
4	Hot air oven
5	Vortex mixer
6	Water bath
7	Heating mantle
8	Magnetic stirrer
9	UV chamber
10	Inoculation chamber
11	pH meter
12	Colony counter
13	Refrigerator
14	Bunsen burner
15	Micrometer (stage and ocular)
16	Colorimeter
17	Membrane filter set
18	Centrifuge
19	Electronic shaker Incubator
20	Electronic Analytical Balance
21	Double-pan Analytical Balance
22	Spectrophotometer
23	Computers
24	Water distillation system
25	Haemocytometers
26	Inspissator

Saurashtra University, Rajkot
B.Sc. (Honours) / B.Sc. (Honours with Research) MICROBIOLOGY PROGRAMME
Syllabus for A.Y. 2023-2024 & Onwards
Semester - I

23-MBTH101	Fundamentals of Microbiology (Theory)	3hrs/week	3 Credits
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10. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
11. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
12. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
13. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
14. Holistic Education Multidisciplinary Interdisciplinary
15. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
16. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
17. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
18. ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

Course Description:

Microbiology is a branch of science that deals with the study of microorganisms. The course will discuss microbiology's basic concepts, including the scope, history, groups, and places of microorganisms in the living world. Techniques such as the use of microscopy and staining for observation are also a component of the course. Morphology, nutritional requirement, and growth pattern of bacteria have also been covered in the course.

Course objectives:

After completing this course, the student should be able to:

1. Identify the significant contributions of the early scientists and the historical milestones that laid the groundwork for modern microbiology.
2. Understand the characteristics of major groups of microorganisms.
3. Explain the fundamentals of microscopy and staining technique.
4. Understand the characteristics of prokaryotic cells and eukaryotic cells.
5. Identify, discuss, and illustrate morphological features of the bacterial cell and its organelles.
6. Understand the nutritional requirements of microbes.
7. Explain the principle and the techniques of microbial cultivation.
8. Comprehend various phases of the bacterial lifecycle and the techniques of its measurement.
9. Know the methods of pure culture.

Course Content	Hours
Unit 1: Scope and History of Microbiology	9 hrs
<ul style="list-style-type: none"> • Microbiology as a field of Biology • Mile stones of Microbiology • The Place of Microorganisms in the living world; Distribution of Microorganisms in Nature • Applied areas of Microbiology 	
Unit 2: Major Groups of Microorganisms	9 hrs
<ul style="list-style-type: none"> • Difference between Eukaryotes, Prokaryotes and Archaea • Major groups of Microorganisms: Structure and types of Prokaryotic microbes • Eukaryotic Microorganisms: Structure and types of Fungi, Algae, Protozoa • Akaryotic microbe: Structure and types of Viruses 	
Unit 3: Microscopy	9 hrs
<ul style="list-style-type: none"> • Microscopy: Introduction and Types • Principle, and working of : Bright field Microscopy, Dark field Microscopy • Principle, and working of : Fluorescent Microscopy, Phase Contrast Microscopy • Electron Microscopy – Types, working and Limitations 	
Unit 4: Staining	9 hrs
<ul style="list-style-type: none"> • Stains and staining solutions • Types of Stains: Natural, Acidic & Basic Stains • Chromophore & Auxochrome groups, Leuco compounds • Types of Staining 	
Unit 5: Morphology of Microorganisms	9 hrs
<ul style="list-style-type: none"> • Size, Shape, and Arrangement of Bacteria • Bacterial Structures – External to Cell Wall: Capsule, Flagella, Pili, Prostheca, Sheath & Stalk • The cell wall of Bacteria – Structure and chemical composition of Gram-negative and Gram-positive Bacterial cell wall • Bacterial Structures – Internal to Cell Wall: Cell Membrane, Cytoplasm, Cytoplasmic inclusions, Endospores, Cyst and Nuclear Material. 	

Text Books:

- Pelczar, M.J., Chan, E.C.S., Kreig, N.R. (2003). Microbiology 5th Edition, Tata McGraw-Hill Publication Company (UNIT-1,5)
- Prescott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology 5th edition, New York: WCB McGrawHill publication

Reference Books:

- Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.
- Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.
- Modi, H.A. Elementary Microbiology - Vol –I & II, Akta Prakashan, Nadiyad.
- Atlas. R.M., Principles of Microbiology- 2nd Edition
- Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.

Pedagogic tools:

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

Suggested reading / E-resources

1. <https://www.youtube.com/watch?v=qCn92mbWxd4>
2. <https://www.youtube.com/watch?v=AZS2wb7pMo4>

Suggested MOOCs

1. https://onlinecourses.swayam2.ac.in/cec23_bt14/preview

23-MBPR101	Fundamentals of Microbiology (Practical)	2hrs/week	1 Credits
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1. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
5. Holistic Education Multidisciplinary Interdisciplinary
6. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
7. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
9. ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

Course Description:

This course covers the study of basic skills in the subject of Microbiology. The course is designed to make students aware about the Good microbiology Laboratory Practices, basic introduction about sterilization of media and glassware and observation of Microbes under the microscope using appropriate staining techniques.

Course Objective:

This course aims to provide the students with a basic understanding of microbial techniques and instrument operation. The course is designed so that learners can understand the Good laboratory practices, basic instrumentation needed for conducting experiments in a Microbiology laboratory, simple techniques of observation and study of microbial morphology and cellular structure, methods of microbial control, etc., in detail.

Sr. No.	Experiments
1	Principles, working, and uses of the following laboratory instruments: a) Microscope b) Incubator c) pH meter d) Refrigerator e) Colorimeter f) Colony counter
2	Principles, working, and uses of the following sterilizers: a) Autoclave b) Hot air oven

	c) Steam sterilizer d) Inspissator e) Bacteriological filters.
3	Preparation of glassware for sterilization and disposal of laboratory media and cultures.
4	Preparation of Stains and Staining Reagents.
5	Study of Permanent Slides of Bacteria, Fungi, Algae, and Protozoa.
6	Study of bacterial motility by hanging drop method.(Demonstration)
7	Monochrome Staining: a) Negative Staining b) Positive Staining
8	Differential Staining: Gram's Staining
9	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 ;

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand& Company Ltd., New Delhi
4. Konika Sharma, Manual of Microbiology – Tools and Techniques, Ane books, Delhi

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Video

Suggested reading / E-resources

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7757301/>
- <https://biochemden.com/download-biochemistry-protocols/>
- <https://www.youtube.com/watch?v=1iYAC6KISMk>
- <https://www.youtube.com/watch?v=YO244P1e9QM>

Suggested MOOCs

1. <https://www.my-mooc.com/en/mooc/biochemistry-biomolecules-methods-and-mechanisms/>

23-MBTH102	Basics of Microbial Chemistry (Theory)	3hrs/week	3 Credits
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1. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
5. Holistic Education Multidisciplinary Interdisciplinary
6. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
7. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
9. ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

Course Description:

Basic Biochemistry is appropriate for students with some background in the fundamentals of biochemistry. This course introduces the basic structure and functions of elements of life and the biomolecules as well. From this subject student will be able identify the basic structure of monosaccharide, amino acids, nitrogenous base, and other polymeric forms of biomolecules like carbohydrates, proteins, lipids and nucleic acids through the lectures, group activities, class test and homework projects. after complications of this paper students can very well understand the basic properties and the importance of biomolecules in the biological system.

Course Objectives:

After completing this course, the student should be able to:

1. Understand the basic structure of cellular matter, various types of reactions, pH scale and the special properties of water
2. Understand the structure of fundamental monosaccharide, its properties and polysaccharides
3. Understand the structures of amino acids, their chemical properties and their organization into polypeptides and proteins.
4. Understand structure and basic function of nucleotides
5. Understand structure of different classes of lipids and their roles in biological systems
6. Outline the chemical and physical properties of enzymes, mechanism of enzyme actions, factors affecting enzyme activity and enzyme synthesis.

Course Content	Hours
UNIT 1: Basic Biochemistry	9hrs
<ul style="list-style-type: none"> • Introduction to Atoms, Elements & Molecules • Major Chemical bonds found in biological system: Ionic Bonds, Covalent Bonds, 	

Hydrogen Bonds, Van der Waals interactions, Hydrophobic interactions <ul style="list-style-type: none"> • Major Chemical reactions: Acid Base, Redox, Condensation-Hydrolysis Reactions • Water and pH - important properties 	
UNIT 2: Carbohydrates	9hrs
<ul style="list-style-type: none"> • Definition and Classification of Carbohydrates • Structure and properties of Monosaccharide • Types and importance of Disaccharides • Types of importance of Polysaccharides 	
UNIT 3: Proteins	9hrs
<ul style="list-style-type: none"> • Definition and Functions of Proteins • Amino acids: Classification • Physical & Chemical Properties of Amino acids • Structure of Proteins: Primary, Secondary, Tertiary & Quaternary Levels 	
UNIT 4: Lipids and Nucleic acids	9hrs
<ul style="list-style-type: none"> • Definition, Functions and Classification of Lipids • Introduction and significance of Fatty acids, Triacylglycerol, Phospholipid and Steroid • Introduction to Nitrogen Base, Nucleosides & Nucleotides, Structure of Deoxyribonucleic acid: A-DNA, B-DNA, Z-DNA • Introduction to RNA & its types 	
UNIT 5: Enzymes	9hrs
<ul style="list-style-type: none"> • Definition of Enzymes, Apoenzyme, Core Enzyme, Holo enzyme, Coenzyme, Cofactors, Prosthetic Groups, and Classification • Mechanism of enzyme action – Active Sites, Activation Energy, Lock & Key Model, Induced Fit model • Factors affecting enzyme activity • Enzyme inhibition 	

Text Books:

- Atlas, R.M., Bartha, R. (1997). Microbial Ecology, 4th Edition: Benjamin Cummings publication (UNIT: 1)
- Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi. (UNIT: 2 – 5)
- Powar, C.B., Dagainawala, J.F. (2010). General Microbiology Vol-I. Mumbai: Himalaya Publishing House. (UNIT: 2 - 5)

Reference Books:

- Conn E.E., Stumpf P.K. (1989). Outlines of Biochemistry. Wiley publication.
- Stanier, R.Y. (1987). General Microbiology, 5th Edition: Macmillan publication.
- Nelson, D.L., Cox, M.M. (2013). Lehninger: Principles of Biochemistry. W.H. Freeman publication.

- Satyanarayan, U. (2008). Biotechnology. Kolkata, West Bengal: Books and allied (P) Ltd

Pedagogic tools:

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

Suggested reading / E-resources

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7757301/>
- <https://biochemden.com/download-biochemistry-protocols/>
- <https://www.youtube.com/watch?v=1iYAC6KISMk>
- <https://www.youtube.com/watch?v=YO244P1e9QM>

Suggested MOOCs

- <https://www.my-mooc.com/en/mooc/biochemistry-biomolecules-methods-and-mechanisms/>
- <https://www.edx.org/course/biochemistry-biomolecules-methods-and-mechanisms>

23-MBPR102	Basics of Microbial Chemistry (Practical)	2hrs/week	1 Credits
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1. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
5. Holistic Education Multidisciplinary Interdisciplinary
6. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
7. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
9. ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

Course Description:

This course covers the study of basic structures and properties of various biomolecules. It also emphasise on the use of analytical techniques for the qualitative and quantitative estimation of biomolecules.

Course Purpose:

This course aims to provide basic understanding of qualitative and quantitative estimation of various biomolecules.

Sr. No.	Experiment
1	Measurement and adjustment of pH of various solutions
2	Estimation of Protein by Foiln-Lowry's Method.
3	Estimation of Sugar by Cole's Method.
4	Estimation of Reducing sugar by DNSA method
5	Estimation of DNA by DPA Method.
6	Qualitative Analysis of Carbohydrates.
7	Qualitative Analysis of Proteins & Amino acids.
8	Determination of alpha amylase activity by iodometric method.

Reference Books:

1. Jayaraman, J. (2011). Laboratory Manual in Biochemistry: New Age International Private Limited. India
2. Sawhney S.K., Singh, R. (2005). Introductory Practical Biochemistry: Alpha Science International.
3. Cappuccino, J.G., Sherman, N. (2004). International student edition: Microbiology- A laboratory Manual 4th edition: Benjamin Cummings publications

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Video

Suggested reading / E-resources

<https://www.classcentral.com/course/edx-biochemistry-biomolecules-methods-and-mechanisms-12585>

https://onlinecourses.nptel.ac.in/noc20_cy10/preview

23-MBSE101	Basics of Clinical Laboratory (Skill Enhancement Course)	4hrs/week	2 Credits
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1. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
5. Holistic Education Multidisciplinary Interdisciplinary
6. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
7. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
9. ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

Course Description:

Diagnosis of most of the disease depends upon clinical examination of different body fluids and specimen. Clinical Laboratory is routinely responsible for the qualitative and quantitative analysis of these specimen. Many students after completing graduation in Microbiology choose to persue Madical Laboratory course and plan to open their own laborqatory. This course is an introductory guideline about the basics of Clinical Laboratory and would be very much useful to all those who wants to be a clinical microbiologist.

Course Objectives:

After completing the course, the student shall be able to:

1. Understand the basic set-up of a clinical laboratory
2. Know and understand the principal and operation of different basic instruments in the laboratory
3. Differentiate various types of Clinical samples
4. Understand the procedures for the sample collection, preservation, analysis and result interpretation.

Course Content	Hours
UNITS – 1: Laboratory Set-up	3hrs
<ul style="list-style-type: none"> • Laboratory – types, departments of laboratory and Laboratory set-up • Laboratory safety – universal safety precaution (hand hygiene, PPE, biomedical waste management, sterilization, disinfection.) • Biohazard, chemical hazard, blood spillage management. 	
UNIT – 2: Instrumentation	3hrs
<ul style="list-style-type: none"> • Different type of equipments/instruments and their Principle, procedure, and operation. • Automation – Haematology, biochemistry, microbiology & serology • Installation, operation, maintenance of equipments 	
UNITS –3: Pre-Analytical procedures	3hrs

<ul style="list-style-type: none"> • Various types of specimens, their collection, transportation, preservation, and important instructions. • Turn Around Time • Registration process 	
UNITS –4: Analytical & Post Analytical procedures	3hrs
<ul style="list-style-type: none"> • Diagnostic methods – principle, procedures and reagents • Laboratory Information System • Interpretation of laboratory findings, biological reference value and Reporting of results 	
UNITS –5:Quality control & Documentation	3hrs
<ul style="list-style-type: none"> • Quality control (internal & external), LJ Chart, Westgard rules. • Standard Operating Procedures, work desk instructions, formats, registers and Data maintenance. • Accreditation / Certification 	

Text Book:

- Text book of medical laboratory technology, Praful Godkar; Bhalani Bhalani Publishing House.

Reference Books:

- A Hand Book of D.M.L.T. (Diploma in Medical Laboratory Technology), Payal Soan, Gitesh Amrohit), Vardhan Publishers & Distributors
- Textbook of Medical Laboratory Technology Ramnik Sood Jaypee Brothers Medical Publishers

Pedagogic tools:

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

Suggested reading / E-resources

- <https://www.ncbi.nlm.nih.gov/books/NBK535358/>
- https://www.academia.edu/35543991/Basic_Clinical_Laboratory_Techniques_6th
- <https://www.youtube.com/watch?v=1iYAC6KISMk>
- https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/medicallabtechnology.pdf

Suggested MOOCs

- <https://www.edapp.com/course-collection/free-online-medical-laboratory-courses/>
- <https://www.edx.org/course/biochemistry-biomolecules-methods-and-mechanisms>

Saurashtra University, Rajkot
B.Sc. (Honours) / B.Sc. (Honours with Research) MICROBIOLOGY PROGRAMME
Syllabus for A.Y. 2023-2024 & Onwards
Semester - II

23-MBTH201	Microbial Growth and Control (Theory)	3hrs/week	3 Credits
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1. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
5. Holistic Education Multidisciplinary Interdisciplinary
6. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
7. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
9. ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

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 Content	Hours
Unit-I: Microbial Growth and Nutrition	9 hrs
<ul style="list-style-type: none"> • Introduction and Definition of Growth, Modes of Cell division in procaryotes • Bacterial Growth Curve • Synchronous culture & Continuous Growth of Bacteria • Measurement of Bacterial Growth 	
Unit-II: Microbial cultivation and Pure Culture Techniques	9 hrs
<ul style="list-style-type: none"> • Types of bacteria based on nutritional requirements • Chemical and Physical requirement of Growth- Bacteriological Media, Air, pH & Temperature • Cultivation of Anaerobes • Natural Microbial Population (Mixed Cultures), Selective methods to obtain Pure Cultures, Cultural Characteristics, Isolation, purification and Preservation of pure cultures 	
Unit-III: Control of Microbes by Physical methods	9 hrs
<ul style="list-style-type: none"> • Definitions: Sanitization, Antisepsis, Sterilization, Disinfection, Microbiocidal&Microbiostasis, Thermal Death Time, Thermal Death Point, z-Value & F-value, D-Value • Control by Temperature: a) <u>High Temperature</u>: Moist Heat – Autoclave, Boiling, Pasteurization, Fractional Sterilization High Temperature: Dry Heat – Hot Air Oven, Incineration, b) <u>Control by Desiccation</u> c) <u>Control by Low Temperature</u> • Control by Radiation – UV radiation, x-rays, Gamma rays and Cathode rays • Control by Filtration 	
Unit-IV: Control of Microbes by Chemical methods	9 hrs
<ul style="list-style-type: none"> • Characteristics of an Ideal Antimicrobial agent • Halogens – Iodine & Chlorine, Heavy Metals & Dyes • Phenol & Phenolic compounds, Phenol coefficient method, Alcohols • Detergents & Quaternary Ammonium Compounds, Aldehydes & Gaseous agents 	
Unit- V: Control of Microbes by Antibiotics	9 hrs
<ul style="list-style-type: none"> • Chemotherapeutic agents and Chemotherapy, Characteristics of ideal chemotherapeutic agent • Antibiotics and their mode of action: Inhibition Effect on cell wall synthesis, nucleic acid and protein synthesis, Damage to cytoplasmic membrane, Inhibition of specific enzyme system • Antifungal, antiviral and antitumor chemotherapeutic agents • Microbiological assay of antibiotics 	

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, 5th Edition: Macmillan publication.

Pedagogic tools:

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

Suggested reading / E-resources

<https://www.youtube.com/watch?v=Uf8a7cCVjM4>

<https://www.youtube.com/watch?v=BkbLI2mAMP8>

Suggested MOOCs

- <https://alison.com/course/introduction-to-microbiology>
- <https://extendedstudies.ucsd.edu/courses-and-programs/microbiology-with-lab>

23-MBPR201	Microbial Growth and Control (Practical)	2hrs/week	1 Credits
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Course Description:

This course covers the study of 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.

Sr. No.	Experiment
1	Measurement of size of microorganisms by Micrometry (Demonstration)
2	Calibrations of microscopic measurements (Ocular & stage micrometers)
3	Isolation of microorganisms by various methods
4	Turbidometric study of growth curve of <i>E.coli</i> and derivation of Growth rate & Generation time.
5	Enumeration of bacteria by viable count technique.
6	Enumeration of bacteria by Total Count Technique.
7	Effect of various chemicals on microbial growth
8	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 – 8th edition: MacGraw Hill Company.

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Video

Suggested reading / E-resources

- https://www.youtube.com/watch?v=R6Uv_WJlmM
- https://www.youtube.com/watch?v=KHg_PyjQPwk

Suggested MOOCs

- <https://alison.com/course/introduction-to-microbiology>
- <https://extendedstudies.ucsd.edu/courses-and-programs/microbiology-with-lab>

23-MBTH202	Microbial Taxonomy and Diversity (Theory)	3hrs/week	3 Credits
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1. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
5. Holistic Education Multidisciplinary Interdisciplinary
6. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
7. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
9. ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

Course Description:

The world of microorganisms has great diversity in morphology, physiology, and anatomy among its members. This diversity can be put to beneficial use if studied and understood properly. This course will deal with the basic understanding of various groups of microorganisms, namely bacteria, fungi, algae, protozoa, and viruses, and the system adopted for their scientific classification, nomenclature and identification. The fundamental similarities and basic differences among these group of microbes will also be elucidated, and will be explained from the evolutionary point of view. The course is a fundamental nature for semester – II students who are entering into the wonderful world of microorganisms.

Course Objectives:

1. Identify major groups of microorganisms with respect to it's diversity 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 identification and classification of microorganisms.

Course Content	Hours
Unit. 1: Introduction to Microbial Diversity	9 hrs
• Introduction to Biodiversity- Microbial evolution and diversity, Types of diversity	

<ul style="list-style-type: none"> • Microbial Taxonomy: Introduction and overview, Taxonomic ranks of microorganisms, Classification systems • Major characteristics used in taxonomy • Assessing Microbial Phylogeny 	
Unit. 2: Prokaryotic Diversity	9 hrs
<ul style="list-style-type: none"> • <u>Gram negative bacteria</u> – General features of: <ul style="list-style-type: none"> ○ Aerobic/Microaerophilic motile, helical vibroid ○ Non-motile curved bacteria ○ Aerobic/Microaerophilic rods and cocci • <u>Gram negative bacteria</u> – General features of: <ul style="list-style-type: none"> ○ Facultative anaerobes – rods, curved and helical bacteria ○ Dissimilatory Sulphate reducers • <u>Gram negative bacteria</u> – General features of: <ul style="list-style-type: none"> ○ Anaerobic cocci ○ Phototrophic bacteria • <u>Gram positive bacteria</u> – General features of: <ul style="list-style-type: none"> ○ Endospore forming rods and cocci ○ Asporogenous rods ○ Mycobacteria and Actinomycetes 	
Unit 3: Diversity of some unusual Prokaryotes	9 hrs
<ul style="list-style-type: none"> • <u>General Features of Bacteria with unusual morphology:</u> <ul style="list-style-type: none"> ○ Budding and appendaged bacteria ○ Sheathed Bacteria ○ Mycoplasma • Bacteria with gliding motility, • Rickettsia and Chlamydia • Introduction to Archaea <ul style="list-style-type: none"> ○ Thermophiles ○ Halophiles ○ Acidophiles ○ Barophiles ○ Methanogens ○ Psychrophiles 	
Unit. 4: Eukaryotic Diversity	9 hrs
<ul style="list-style-type: none"> • Fungi: General characteristics – Definition, occurrence, structure and Economic importance of fungi • Algae: General Characteristics – Definition, Occurrence, Ultra- Structure, Reproduction • General Characteristics – Definition, Occurrence, Ultra- Structure, Reproduction and Economic importance of Protozoa • Economic importance of Fungi, Algae and Protozoa 	
Unit. 5: Akaryotic Diversity - Viruses	9 hrs
<ul style="list-style-type: none"> • Introduction to Viruses: Definition, General features of viruses: Size, Capsids symmetry, Chemical Nature, Life cycle • Overview of Bacterial Virus: T4 and Lambda • Overview of plant Virus: TMV • Overview of Animal viruses; HIV 	

Text Books:

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

Reference Books:

1. Modi, H.A. Elementary Microbiology - Vol -I, AktaPrakashan, Nadiyad.
2. Modi, H.A. Elementary Microbiology – Vol-II, AktaPrakashan, Nadiyad.
3. Dubey, R.C.and Maheshwari, D.K., A Text Book of Microbiology, S. Chand Publications, New Delhi.
4. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.
5. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.
6. Atlas. R.M., Principles of Microbiology- 2ndEdition ,

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)

23-MBPR202	Microbial Taxonomy and Diversity (Practical)	2hrs/week	1 Credits
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1. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
5. Holistic Education Multidisciplinary Interdisciplinary
6. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
7. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
9. ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

Course Description:

This course covers the study of isolation and laboratory cultivation of some major groups of microorganisms, like bacteria, fungi, and virus as well as microscopic observation of algae and protozoa from natural sample. Microscopic observation of some intracellular organelles also makes a major part

Course Purpose:

This course aims to provide basic understanding of isolation and cultivation techniques to help student understand the growth characteristics of different microorganisms. The course is designed in such a way that learners will be able to understand the use of various methods of microbial identification, especially by biochemical and morphological methods. Microscopic observation and study of microbial morphology and cellular structure will enable students to identify and distinguish microbes on the basis of morphology and colony characters. This course will also make students skilful in qualitative and quantitative estimation of various biomolecules. Further it will also facilitate students to understand the sub-cellular organelles by microscopic observation of cells. .
of the course.

Sr. No.	Experiment
1	Isolation of Gram negative bacteria from the given sample.
2	Identification of Gram negative bacteria from the given pure culture using biochemical media (<i>E.coli</i> , <i>Enterobacter aerogens</i> , <i>Proteus</i> , <i>Salmonella</i>)
3	Isolation of Gram positive bacteria from the given sample.
4	Identification of Gram positive bacteria from the given pure culture using biochemical media (<i>Bacillus megaterium</i> , <i>Bacillus subtilis</i> , <i>Staphylococcus aureus</i>)

5	Identification of Fungi on the basis of Morphological Characteristics.
6	Cultivation of yeast from different natural samples and its morphological characterization using microscopic observation.
7	Microscopic observation of different algae from the given samples.
8	Microscopic observation of different protozoa from the given sample.
9	Isolation and cultivation of bacteriophage of <i>E.coli</i> from the given sewage sample.

Reference Books:

- Jayaraman, J. (2011). Laboratory Manual in Biochemistry: New Age International Private Limited. India
- Sawhney S.K., Singh, R. (2005). Introductory Practical Biochemistry: Alpha Science International.
- Cappuccino, J.G., Sherman, N. (2004). International student edition: Microbiology- A laboratory Manual 4th edition: Benjamin Cummings publications

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Video

Suggested reading / E-resources

- <https://www.youtube.com/watch?v=5YBdvAiKV24>
- <https://www.youtube.com/watch?v=-IEOxfIPWsk>
- <https://www.youtube.com/watch?v=omOjA-mIZVY>

Suggested MOOCs

- <https://www.my-mooc.com/en/mooc/extremes-life-microbes-diversity-kyotoux-003x-0/>
- <https://www.mbl.edu/education/advanced-research-training-courses/course-offerings/microbial-diversity>
- <https://www.lunduniversity.lu.se/lubas/i-uoh-lu-BIOR18>

23-MBSE201	Mushroom Cultivation (Skill Enhancement Course)	4hrs/week	2 Credits
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1. Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4. Major Minor Skill Enhancement Courses
Ability Enhancement Courses Value Added Courses Exit/ Vocational Courses
5. Holistic Education Multidisciplinary Interdisciplinary
6. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? : હા
7. New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? : હા
9. ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? : હા

Course Profile:

Once called “Food of the Gods”, edible Mushrooms are still treated as a garnish or delicacy and can be considered as healthy food rich in crude fibre, protein, low fat, low calories, high content vitamins, and mineral. Mushrooms also possess multi-functional medicinal properties. Mushroom cultivation technology is environmental friendly as many organic waste and refuse can be used for this purpose. The potential of mushroom farming in generating new employment opportunities is another positive element emanating from mushroom farming ventures. The course aims at developing skills and making the students become self-reliable and employable besides giving them an edge to become entrepreneur. That is, when students pass out of the college with their degrees, they also are equipped with additional skills to meet the challenges in future.

Course Objectives:

The Course is designed:

- To enable the students to identify the edible and poisonous mushrooms.
- To provide hands-on training for the preparation of bed for mushroom cultivation and it's harvesting, pests and diseases control and post harvesting management.
- To provide the students awareness about the marketing trends of Mushrooms.
- To help the students to learn a means of self-employment and income generation.

Course Content	Hours
UNITS – 1: Introduction	3hrs

<ul style="list-style-type: none"> • General History, edible mushrooms, mushrooms with medicinal importance and poisonous mushrooms. • Common Indian mushrooms and morphology, distribution, structure and life cycle of <i>Agaricus</i> • Nutritional value, medicinal value and advantages.. 	
UNIT – 2: Basics of Mushroom Cultivation	3hrs
<ul style="list-style-type: none"> • Fundamentals of cultivation system- small village unit & larger commercial unit. • Principles of mushroom farm layout- location of building plot, design of farm, bulk chamber, composting platform, equipments & facilities , pasteurization room & growing rooms. • Cultivation: Paddy straw mushroom – substrate, spawn making. 	
UNITS –3: Methods of Mushroom Cultivation	3hrs
<ul style="list-style-type: none"> • Bed method, polythene bag method, field cultivation. • Oyster mushroom cultivation –Substrate, spawning, pre-treatment of substrate. • The Indian scenario 	
UNITS –4: Post Cultivation process	3hrs
<ul style="list-style-type: none"> • Maintenance and Storage of mushroom – short term and long term storage. • Diseases- Common pests, disease prevention and control measures. • Processing - Blanching, steeping, sun drying, canning, pickling, freeze drying. 	
UNITS –5: Economics of Mushroom Cultivation	3hrs
<ul style="list-style-type: none"> • Production level and economic return • Foreign exchange from Mushroom cultivating Countries • International trade. 	

Text Books

1. Harander Singh. 1991. Mushrooms- The Art of Cultivation- Sterling Publishers.
2. Kaul, T.N. (1997). Introduction to Mushroom Science (Systematics). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi & Calcutta, India.
3. Vijaya Khader (1998). Mushrooms for Livelihood. Kalyani Publishers, Ludhiana, India.

Reference books

1. Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).
2. Singh, Reeti and Singh, V.C. (2005). Modern Mushroom Cultivation. Agrobios, India.
3. Suman, B.C. and Sharma, V.P. (2005). Mushroom Cultivation and Uses. Agrobios, India.

Pedagogic tools:

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

Suggested reading / E-resources

- <https://www.youtube.com/watch?v=W2mIa0bPjL0>

- <https://www.classcentral.com/course/swayam-vocational-mushroom-production-23137>
- https://onlinecourses.swayam2.ac.in/nos20_ge07/preview

Suggested MOOCs

- <http://ecoursesonline.iasri.res.in/course/view.php?id=150>