MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE

(An Autonomous College)

Affiliated to Periyar University, Salem | Accredited by **NAAC** with '**A**' Grade

Recognized by **UGC** under Section 2(f) & 12 (B)

MUTHAYAMMAL
COLLEGE OF ARTS
AND SCIENCE
(Autonomous)
A UNIT OF VANETRA GROUP
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DEGREE OF BACHELOR OF SCIENCE

Learning Outcomes - Based Curriculum Framework

- Choice Based Credit System

Syllabus for B.Sc., Microbiology

(Semester Pattern)

(For Candidates admitted from the academic year 2021 -2022 and onwards)

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

RASIPURAM - 637 408.

VISION

- To redefine the scope of higher education by infusing into each of our pursuits, initiatives that will encourage intellectual, emotional, social and spiritual growth, thereby nurturing a generation of committed, Knowledgeable and socially responsible citizens.

MISSION

- To Ensure State of the world learning experience
- To espouse value based Education
- To empower rural education
- To instill the sprite of entrepreneurship and enterprise
- To create a resource pool of socially responsible world citizens

QUALITY POLICY

To Seek – To Strive – To Achieve greater heights in Arts and Science, Engineering, Technological and Management Education without compromising on the Quality of Education.

DEPARTMENT OF MICROBIOLOGY

VISION

- To provide education that gives self employment and build a strong academic industry

MISSION

- To provide value and need based education

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates will be able to promote learning environment to meet the industry expectation.

PEO2: Graduates will be incorporated the critical thinking with good Communication and Leadership skills to become a self-employed

PEO3: Graduates will be uphold+A2 the human values and environmental sustenance for the betterment of the society..

GRADUATE ATTRIBUTES

Graduate Attributes of B.Sc., Microbiology are:

GA 1 Analytical Reasoning

GA 2 Critical Thinking

GA 3 Problem Solving Skills

GA 4 Communication Skills

GA 5 Leadership Quality

GA 6 Team work

GA 7 Lifelong Learning

PROGRAMME OUTCOMES (POs)

PO1: Graduates will acquire dynamic skills through proper perception of the course objectives that leads to scientific and analytical comprehension of the concepts;

PO2: Graduates will focus on sustainable goals that might bring about spherical developments

PO3: Graduates will infuse a spirit converging on bricking a team work, interpersonal and administrative skills to think critically and execute effectively

PO4: Graduates will apply reasoning appropriately to scale the humps in learning and solute them to the core.

PO5: Graduates will engage the skills obtained in independent and collaborative learning as a perennial process.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

After the successful completion of B.Sc. Program, the students are expected to

PSO1: Learn recent development and techniques in Microbiology

PSO2: Understand the general course emphasizing distribution, morphology and physiology of microorganisms in addition to skills in aseptic procedures, isolation and identification of microorganisms

PSO3: Application of knowledge and techniques of basic sciences related to biological sciences

PSO4: Scale up of biochemical process after designing, optimization and analysis for developing products required for society

PSO5: Implementation of professional skills solutions for the betterment of society keeping the environmental context in mind, be aware of professional ethics and communicate effectively

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (Autonomous) - Rasipuram - 637 408
Scheme of Examinations LOCF-CBCS Pattern
(for the Students Admitted from the Academic Year:2021-2022 Onwards)
Programme : B.Sc.MICROBIOLOGY

S.No.	PART	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX.MARKS		
					Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - I										
1	I	LANGUAGE-I	21M1UFTA01	TAMIL - I	6		3	25	75	100
2	II	LANGUAGE-II	21M1UCEN01	COMMUNICATIVE ENGLISH - I	6		3	25	75	100
3	III	DSC THEORY - I	21M1UMBC01	BASICS OF MICROBIOLOGY	4		4	25	75	100
4	III	DSC PRACTICAL - I	21M1UMBP01	PRACTICAL : BASICS OF MICROBIOLOGY		3	2	40	60	100
5	III	GEC THEORY - I	21M1UBCA01	ALLIED : BIOCHEMISTRY- I	4		4	25	75	100
6	III	GEC PRACTICAL - I	21M1UBCAP1	PRACTICAL : ALLIED -BIOCHEMISTRY		3				
7	IV	AECC - VALUE EDUCATION	21M1UVED01	YOGA	1		2	100		
8	IV	PROFESSIONAL ENGLISH - I	21M1UPEL01	PROFESSIONAL ENGLISH FOR LIFE SCIENCES-I	3		2	25	75	100
				TOTAL	24	6	20	265	435	600
SEMESTER - II										
1	I	LANGUAGE - I	21M2UFTA02	TAMIL - II	6		3	25	75	100
2	II	LANGUAGE - II	21M2UCEN02	COMMUNICATIVE ENGLISH - II	6		3	25	75	100
3	III	DSC THEORY - II	21M2UMBC02	MICROBIAL PHYSIOLOGY AND METABOLISM	4		4	25	75	100
4	III	DSC PRACTICAL - II	21M2UMBP02	PRACTICAL : MICROBIAL PHYSIOLOGY		3	2	40	60	100
5	III	GEC THEORY - II	21M2UBCA02	ALLIED- BIOCHEMISTRY - II	4		4	25	75	100
6	III	GEC PRACTICAL - I	21M2UBCAP1	PRACTICAL : ALLIED -BIOCHEMISTRY		3	3	40	60	100
7	IV	AECC - ENVIRONMENTAL STUDIES	21M2UEVS01	ENVIRONMENTAL STUDIES	2		2	100		
8	IV	PROFESSIONAL ENGLISH - II	21M2UPEL02	PROFESSIONAL ENGLISH FOR LIFE SCIENCES-II	2		2	25	75	100
				TOTAL	24	6	23	305	495	700

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Scheme of Examinations LOCF-CBCS Pattern
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Programme : B.Sc.MICROBIOLOGY

S.No.	PART	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX.MARKS		
					Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - III										
1	I	LANGUAGE - I	21M3UFTA03	TAMIL - III	6		3	25	75	100
2	II	LANGUAGE - II	21M3UCEN03	COMMUNICATIVE ENGLISH - III	6		3	25	75	100
3	III	DSC THEORY - III	21M3UMBC03	MICROBIAL GENETICS AND MOLECULAR BIOLOGY	5		4	25	75	100
4	III	DSC PRACTICAL - III	21M3UMBP03	PRACTICAL : MICROBIAL GENETICS		3	2	40	60	100
5	III	GEC THEORY - III	21M3USTA05	ALLIED : BIOSTATISTICS	5		4	25	75	100
6	IV	SEC THEORY - I	21M3UMBS01	SEC -I	3		2	25	75	100
7	IV	NMEC - I	21M3UBTN01	NMEC - I	2		2	25	75	100
				TOTAL	27	3	20	190	510	700
SEMESTER - IV										
1	I	LANGUAGE - I	21M4UFTA04	TAMIL - IV	5		3	25	75	100
2	II	LANGUAGE - II	21M4UCEN04	COMMUNICATIVE ENGLISH - IV	5		3	25	75	100
3	III	DSC THEORY - IV	21M4UMBC04	IMMUNOLOGY AND IMMUNOTECHNOLOGY	6		4	25	75	100
4	III	DSC PRACTICAL - IV	21M4UMBP04	PRACTICAL : IMMUNOLOGY		3	2	40	60	100
5	III	GEC THEORY - IV	21M4UCSA05	ALLIED : COMPUTER APPLICATIONS IN BIOLOGY	4		3	25	75	100
6	III	GEC PRACTICAL - II	21M4UCSAP5	PRACTICAL : ALLIED - OFFICE AUTOMATION		3	2	40	60	100
7	IV	SEC THEORY - II	21M4UMBS02	SEC -II	2		2	25	75	100
8	IV	NMEC - II	21M4UZON03	NMEC - II	2		2	25	75	100
9	V	NAAN MUTHALVAN SKILL COURSE		DIGITALS SKILLS FOR EMPLOYABILITY						
				TOTAL	24	6	21	230	570	800

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Scheme of Examinations LOCF-CBCS Pattern
(for the Students Admitted from the Academic Year:2021-2022 Onwards)
Programme : B.Sc.MICROBIOLOGY

S.No.	PART	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX.MARKS		
					Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - V										
1	III	DSC THEORY - V	21M5UMBC05	MEDICAL BACTERIOLOGY AND MYCOLOGY	6		5	25	75	100
2	III	DSC THEORY - VI	21M5UMBC06	FOOD AND INDUSTRIAL MICROBIOLOGY	6		5	25	75	100
3	III	DSE - I	21M5UMBE01	ELECTIVE - I	6		5	25	75	100
4	III	DSE - II	21M5UMBE02	ELECTIVE - II	6		5	25	75	100
5	III	DSC PRACTICAL - V	21M5UMBP05	PRACTICAL : MEDICAL MICROBIOLOGY, FOOD AND INDUSTRIAL MICROBIOLOGY		3	2	40	60	100
6	IV	SEC THEORY - III	21M5UMBS03	SEC - III	3		2	25	75	100
7	IV	INTERNSHIP	21M5UMBIS1	INTERNSHIP						
				TOTAL	27	3	24	165	435	600
SEMESTER - VI										
1	III	DSC THEORY - VII	21M6UMBC07	AGRICULTURAL MICROBIOLOGY AND PLANT PATHOLOGY	5		5	25	75	100
2	III	DSC THEORY - VIII	21M6UMBC08	ENVIRONMENTAL MICROBIOLOGY AND BIODEGRADATION	5		5	25	75	100
3	III	DSE - III	21M6UMBE03	ELECTIVE - III	5		5	25	75	100
4	III	DSE - IV	21M6UMBE04	ELECTIVE - IV	5		5	25	75	100
5	III	DSC PRACTICAL -VI	21M6UMBP06	PRACTICAL : AGRICULTURAL & ENVIRONMENTAL MICROBIOLOGY		3	2	40	60	100
6	III	PROJECT WORK	21M6UMBPR1	PROJECT WORK		3	5	40	60	100
7	III	ONLINE - COMPETITIVE EXAMINATION	21M6UMBOE1	MICROBIOLOGY FOR COMPETITIVE EXAMINATIONS			2	100		
8	IV	SEC THEORY - IV	21M6UMBS04	SEC - IV	4		2	25	75	100
9	V	EXTENSION ACTIVITY	21M6UEXA01	EXTENSION ACTIVITY			1			
10	V	NAAN MUTHALVAN SKILL COURSE		EMPLOYABILITY READINESS (ADD ON COURSE)						
				TOTAL	24	6	32	305	495	700
				OVER ALL TOTAL	150	30	140	1660	2940	4100
1	VI	EXTRA CREDIT COURSE	21M6UMBEC1	MOOC Courses offered in SWAYAM / NPTEL	-	-	2	-	-	-
2	VI	EXTRA CREDIT COURSE	23UMBVAC01	VALUE ADDED COURSE- BIOFERTILIZERS AND BIOPESTICIDES PRODUCTION			2			

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PRINCIPAL
MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE
(AUTONOMOUS)
RASIPURAM - 637 408
NAMAKKAL DIST.

UG-REGULATION

1. Internal Examination Marks- Theory

Components	Marks
CIA I&II	15
Attendance	5
Assignment	5
Total	25

Attendance Percentage	Marks
96 %to 100%	5
91%to 95%	4
86%to 90%	3
81%to 85%	2
75%to 80%	1
Below 75%	0

2. QUESTION PAPER PATTERN FOR CIA I, II AND ESE (3 HOURS) MAXIMUM: 75 Marks

SECTION-A (10 Marks) (Objective Type)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks (10 x1=10 marks)

SECTION-B (10 Marks) (Short Answer)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks (5 x 2 = 10 marks)

SECTION-C (25 Marks) (Either or Type)

Answer any **FIVE** questions

ALL Questions Carry **EQUAL** Marks

Either or Type. (5 x 5 = 25 marks)

SECTION-D (30 Marks) (Analytical Type)

Answer any **THREE** Questions out of **FIVE** questions

ALL Questions Carry **EQUAL** Marks (3 x 10 = 30 marks)

(Syllabus for CIA-I 2.5 Unit , Syllabus for CIA-II All 5 Unit)

2a) Components for Practical CIA.

Components	Marks
CIA –I	15
CIA - II	15
Observation Note	5
Attendance	5
Total	**40**

2. b) Components for Practical ESE.

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
Total	**60**

3. Guidelines for Value Education Yoga and Environmental Studies (Part IV)

- The Course Value Education Yoga istobetreatedas100%CIA coursewhichisofferedinI Semester for I year UG students.
- TheCourseEnvironmentalStudiesistobetreatedas100%CIAcoursewhichisofferedinII Semester for I year UG students.
- Total Marks for the Course=100

Components	Marks
Two Tests (2 x30)	60
Field visit and report (10+10)	20
Two assignments (2 x10)	20
Total	100

The passing minimum for this course is 40%

- In case, the candidate fails to secure 40% passing minimum, he/she may have to reappear for the same in the subsequent odd / even semesters.

4. Guidelines for Extension Activity (Part V)

- At least two activities should be conducted within semester consisting of two days each.
- The activities may be Educating Rural Children, Unemployed Graduates, Self Help Group etc.

The marks may be awarded as follows,

No of Activities	Marks
2 x50 (Each Activity for two days)	100

5. Internship/Industrial Training, Mini Project and Major Project Work

Internship/Industrial Training		**Mini Project**	**Major Project Work**	
Components	**Marks**	**Marks**	**Components**	**Marks**
CIA*2			**CIA**	
Work Diary	25	-	a) Attendance 10 Marks	
Report	50	50	**b)** Review /Work Diary*1 30 Marks	40
Viva–voce	25	50		
Examination				
Total	**100**	**100**	**ESE*2**	
			a)Final Report 40Marks	
			b)Viva-voce 20Marks	60
			Total	**100**

*[1]Review is for Individual Project and Work Diary is for Group Projects (Group consisting of minimum3 and maximum 5)

*[2]Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

6. Guidelines for Competitive Exams- Online Mode (PartIII)- Online Exam 3 hours

Components	Marks
100 Objective Type Questions 100*1=100 Marks	100

Objective type Questions from Question Bank.

- The passing minimum for this paper is40%
- Incase, the candidate fails to secure 40% passing minimum, he/she may have to reappear for the same in the subsequent semesters.

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B.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M1UMBC01	**BASICS OF MICROBIOLOGY**	**DSC THEORY - I**	**I**	**4**	**4**	**-**	**-**	**4**
Objective	This subject aims to introduce the history, invention and development of Microbiology for the beginners to progressive advancement							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	Definition and scope of Microbiology – History and recent developments Spontaneous generation – Biogenesis Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Elie Metchnikoff and Fleming.	K1-K2	9
II	Microscopy – Simple and compound Microscopy – Dark field – Phase contrast – Fluorescence and Electron Microscopy.	K1-K2	9
III	Microbial Evolution and Diversity – Endo symbiotic theory. Binomial nomenclature of Microbes. Classification - Five kingdoms concept - Eight kingdoms concept (Cavalier Smith).	K1-K2	9
IV	Anatomy of prokaryotes - cell wall, cytoplasmic membrane, cilia, flagella capsule, cytoplasmic inclusions, sporulation. Stain and Staining techniques – Simple, differential and special staining.	K1-K3	9
V	Sterilization - methods of sterilization and Disinfection. Antimicrobial chemotherapy - tests for sensitivity to antimicrobial agents.	K1-K3	9
Course Outcome	**CO1:** Students will remember and understanding about the history and inventions.	K1	
	CO2: To understand the concepts of microscopy and its applications.	K2	
	CO3: Illustrate the knowledge about microbial evolution and diversity.	K2	
	CO4: Apply the information on anatomy of prokaryotes and its observations.	K3	
	CO5: Apply the previous learning to current applications.	K3	

Learning Resources	
Text Books	1. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). "Microbiology"- 5th Edition McGraw Hill Inc. New York. 2. Hans G. Schlegel. General microbiology. 7'h edition. Cambridge university press (1993).

Reference Books	1. Prescott L M, J P Harley and D A Klein (2005). Microbiology. Sixth edition, International edition, McGraw Hill. 2. Joanne Willey and Kathleen Sandman and Dorothy Wood, 2020, Prescott's Microbiology, ISBN10: 1260211886 Willey. 3. Sundara Rajan S (2003). College Microbiology. Volume 1 & 2. Revised Edition, Vardhana Publications, Bangalore.
Website Link	1. https://www.elsevier.com/books/encyclopedia-of-microbiology/schmidt/978-0-12-811736-1 2. https://www.researchgate.net/publication/324037626_Basic_Medical_Microbiology 3. https://www.researchgate.net/publication/264121594_A_textbook_of_Microbiology

	L-Lecture	T-Tutorial	P-Practical	C-Credit		

B.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Title	Course Type	Sem.	Hours	L	T	P	C
21M1UMBC01	BASICS OF MICROBIOLOGY	DSC THEORY - I	I	4	4	-	4

CO-PO Mapping

P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
S	S	M	M	S	S	L	S	S	M
S	S	M	M	S	S	L	S	S	L
S	S	M	M	S	S	M	S	S	S
S	S	M	S	S	S	M	S	S	S
S	L	M	S	S	S	M	S	S	M

L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, PPT, Video presentation
Assessment Methods	Model Practical Test, Group Project, Model Presentation

Designed By	Verified By	Approved By
Mrs.S.Vahithabanu	Dr.M.Selvan	Dr.S.SHAHITHA

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Curriculum Development Cell MCAS (Autonomous) Pasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M1UMBCP01	**Practical : Basics of Microbiology**	**CORE PRACTICAL - I**	**I**	**3**	**-**	**-**	**3**	**2**
Objective	To learn about the basic physiological factors and bacterial identification methods							

S.No.	Course Content	Knowledge Levels	Sessions
1	Laboratory practice & precautions	K1	3
2	Handling of Instruments& cleaning of glassware's.	K1	3
3	Handling of microscopes and its operations	K1-K2	3
4	Handling of laboratory instruments a. Autoclave b. Hot air oven c. Laminar air flow d. pH meter e. Colony counter f. Incubator g. Anaerobic jar.	K1-K3	6
5	Staining techniques a. Smear preparation: Heat fixation, simple staining procedure b. Differential staining (Gram's and Acid fast staining) c. Special staining (Spore and Capsular staining methods)	K1-K3	9
6	Media preparation a. Liquid media – Peptone water, Nutrient broth. b. Solid media – Nutrient agar (Agar slant, Agar plate – streaking method c. Enriched Medium – Blood agar d. Differential medium – Mac Conkey agar, SS Agar. e. Selective medium – EMB, MSA.	K1-K4	9
7	Anaerobic cultivation –Wright's tube method (Demonstration)	K1-K4	3
Course Outcome	**CO1:** Remember the laboratory Practices and Precautions in Microbiology Laboratory.	K1	
	CO2: Understand the basic instruments handling and cleaning.	K2	
	CO3: Understand and apply the various staining methods for identifying bacteria.	K3	
	CO4: Apply and analyze the various types of media preparations for bacterial growth.	K4	
	CO5: Apply and survey the anaerobic cultivation of bacteria.	K4	
Learning Resources			

Text Books	1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai. 2. James Cappuccino. Microbiology: A Laboratory Manual (10th Edition). Kannan N (2003). Handbook of Laboratory Culture Media, Reagents, Stains and Buffers. Panima Publishing Corporation, New Delhi.
Reference Books	1. Dubey RC and Maheswari DK (2004). Practical Microbiology 1st Edition, S.Chand& Company Ltd., New Delhi. 2. Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers.
Website Link	1. https://www.frontiersin.org/books/Microbial_Physiology_and_Metabolism 2. https://onlinelibrary.wiley.com/doi/book/10.1002/0471223867 3.https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Book%3A_General_Microbiology_Lab_Manual_(Pakpour_and_Horgan)

B.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M1UMBCP01	PRACTICAL: BASICS OF MICROBIOLOGY	DSC PRACTICAL - I	I	3	-	-	3	2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	S	S	L	S	S	M
CO2	S	S	M	M	S	S	L	S	S	L
CO3	S	S	M	M	S	S	M	S	S	S
CO4	S	S	M	S	S	S	M	S	S	S
CO5	S	L	M	S	S	S	M	S	S	M

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, PPT, Video presentation
Assessment Methods	Model Practical Test, Group Project, Model Presentation

Designed By	Verified By	Approved By
Mrs.S.Vahithabanu	Dr.M.Selvan	

07/02/22

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2UMBC02	MICROBIAL PHYSIOLOGY AND METABOLISM	DSC THEORY - II	II	4	4			4
Objective	To understand the kinetics of microbial growth and influence of varied physio - chemical parameters							

Unit	Course Content	Knowledge Levels	Sessions
I	Nutritional requirements of Microorganisms- Autotrophs, Heterotrophs, Chemotrophs, Copiotrophs and Oligotrophs. Transport Mechanisms - Diffusion- Facilitated Diffusion, Active transport- Group translocation.	K1-K2	9
II	Different phases of growth - Growth curve - Generation time - Factors influencing microbial growth - Temperature, pH, hydrostatic pressure and radiation synchronous growth and continuous cultivation. Diauxic growth, Sporulation – Endospore formation in bacteria.	K1-K3	9
III	Metabolism - EMP, HMP, EDPathway - TCA cycle - Electron transport chain, Phosphorylation, Oxidative Phosphorylation, Substrate level Phosphorylation	K1-K2	9
IV	Anaerobic respiration - sulphur, nitrogenous compounds and C02 as a final electron acceptor- Fermentation: Alcoholic fermentation, mixed acid fermentation, lactic acid fermentation	K1-K3	9
V	Photosynthesis - Characteristics and types of Photosynthetic Prokaryotes. C02 fixation Oxygenic and Anoxygenic - Bio luminescence.	K1-K3	9
Course Outcome	**CO1:** Remember about the basic nutritional requirements of Microorganisms.	K1	
	CO2: Understand the knowledge on the growth pattern of microorganisms.	K2	
	CO3: Understand the information on energy deriving mechanism.	K2	
	CO4: Interpret the information on synthesis of organic molecules via respiration.	K3	
	CO5: Show the information on synthesis of organic molecules via photosynthesis.	K3	

Learning Resources	
Text Books	1. Prescott L M, J P Harley and D A Klein (2005). Microbiology. Sixth edition, International edition, McGraw Hill. 2. Moat G, John W. Foster and Michael P. Spector (2002). Microbial physiology. Fourth edition, A John Wiley sons, Inc. publication. New Delhi.

Reference Books	1. Pelczar TR M J Chan ECS and Kreig N R (2006). Microbiology. Tata McGraw-Hill INC., New York. 2. Robert F Boyd (1984). General Microbiology. Times mmor I Mosby college publishers. 3. David white. The physiology and biochemistry of prokaryotes. Oxford university press. 4th edition (2011).
Website Link	1. https://www.elsevier.com/books/bacterial-physiology-and metabolism/sokatch/978-1-4832-3137-2. 2. https://www.frontiersin.org/journals/microbiology/sections/microbial- physiology-and-metabolism. 3. https://www.macmillanlearning.com/college/ca/product/Lehninger-Principles-of-Biochemistry/p/1319228003

	L-Lecture	T-Tutorial	P-Practical	C-Credit	

B.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2UMBC02	MICROBIAL PHYSIOLOGY AND METABOLISM	DSC THEORY - II	II	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	M	M	M	M	S	M	S	S	L
CO5	S	M	M	M	M	S	M	S	S	L

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, PPT, Video presentation
Assesment Methods	Unit Test, Class Test, Assignment, Internal Examination, Model Presentation

Designed By	Verified By	Approved By
Mrs.N.Sathyabama	Dr.M.Selvan	

Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2UMBCP02	PRACTICAL : MICROBIAL PHYSIOLOGY	DSC PRACTICAL - II	II	3	-	-	3	2
Objective	To learn about the basic physiological factors and bacterial identification methods							

S.No.	Course Content	Knowledge Levels	Sessions
1	Pure culture techniques: streak, spread and pour plate methods	K1-K3	3
2	Culture characteristics of Microorganisms- colony morphology, shape and margin	K2-K3	3
3	Motility determination - Hanging drop method and semisolid agar	K2-K3	2
4	Staining of microorganisms – Grams staining, AFB staining, Capsular staining and spore staining	K2-K4	6
5	Biochemical test- IMViC test, Oxidase test, Catalase test, Urease test, and Nitrate reduction test	K2-K4	6
6	Enzymatic Hydrolysis of Starch, Gelatin and Casein	K2-K4	6
7	Bacterial Growth curve	K2-K4	3
8	Studying the effect of temperature, pH, carbon and nitrogen sources on bacterial growth	K2-K4	3
9	Anaerobic cultivation- candle jar, gas pack and Pyrogallol method	K2-K4	3
Course Outcome	**CO1:** Remember the methods of isolation of bacteria.	K1	
	CO2: Understand the basic identification methods.	K2	
	CO3: Demonstrate the various biochemical identification of bacteria.	K3	
	CO4: Compare the parameters of bacterial growth.	K4	
	CO5: Assess the anaerobic cultivation of bacteria.	K5	

Learning Resources

Text Books	1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai. 2. Sundararaj T. Microbiology laboratory manual. Revised and published by Aswathy Sundararaj. No.5 First Cross Street, Thirumalai Nagar, Perungudi, Chennai.
Reference Books	1. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. Sixth edition, Published by Pearson Education.

	2. Kannan N (1996). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. Tamil Nadu. 3. Harold J Benson (1998).Microbiological Applications Laboratory Manual in General Microbiology. Seventh International edition, Me Grew - Hill, Boston.
Website Link	1. https://www.frontiersin.org/books/Microbial_Physiology_and_Metabolism 2. https://onlinelibrary.wiley.com/doi/book/10.1002/0471223867 3.https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Book%3A_General_Microbiology_Lab_Manual_(Pakpour_and_Horgan)

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2UMBCP02	PRACTICAL : MICROBIAL PHYSIOLOGY	DSC PRACTICAL - II	II	3	-	-	3	2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	S	S	L	S	S	L
CO2	S	S	M	M	S	S	L	S	S	L
CO3	S	S	M	M	S	S	M	S	S	L
CO4	S	S	M	M	S	S	M	S	S	L
CO5	S	S	M	M	S	S	M	S	S	L
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation
Assessment Methods	Model practical and ESE

Designed By	Verified By	Approved By
Mrs.N.Sathyabama	Dr.M.Selvan	A. L. Sam

Curriculum Development Cell MCAS (Autonomous) Rasipuram

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3UMBC03	MICROBIAL GENETICS AND MOLECULAR BIOLOGY	DSC THEORY - III	III	45	5	-	-	4
Objective	To make the students to understand the genetics and molecular biology of microbes. To gather the sound knowledge about gene expressions of target genes.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Historical introduction:** DNA as a genetic material: Experiments of Griffith, Avery, Hershey chase experiment, RNA as a genetic material- Singer experiment, DNA and RNA structure, physical and chemical properties and their types. Cell cycle- Mitosis and Meiosis.	K1-K2	9
II	**DNA replication and Mutation:** DNA replication in prokaryotes - Meselson-Stahl experiment, Mechanism and enzymology of replication, DNA polymerase III structure. Mutation – types of mutation, spontaneous and induced mutation. DNA repair mechanisms.	K1-K2	9
III	**Transcription and Translation:** Transcription in prokaryotes- Initiation, chain elongation and termination of transcription. Translation of proteins - Initiation, elongation and termination of translation. Post translational modification of proteins.	K1-K2	10
IV	**Genetic code and gene expression:** Genetic code- salient features, regulation of gene expression in prokaryotes- Lac operon and trp operon.	K1-K2	8
V	**Gene Transfer:** An Introduction to Transformation, Conjugation and Transduction (Specialized and Generalized). Transposons. Extra chromosomal DNA- Plasmids and Episomes.	K1-K2	9
Course Outcome	**CO1:** Remember about the biomolecules and its mechanisms.	K1	
	CO2: Understand the knowledge about DNA replication process and its complications.	K2	
	CO3: Understand about the biomolecule synthesis.	K2	
	CO4: Produce the knowledge about gene expression.	K3	
	CO5: Apply the knowledge about Gene transfer methods.	K3	
Learning Resources			

Text Books	1. David Frifelder. Microbial Genetics, Narosa publishing house, New Delhi. 1990 2. Daniel L Hartl and Elizabeth W Jones. Genetics-Analysis of Genes and Genomes, Jones and Bartlett publishers, UK. 2001.
Reference Books	1. Stanly R Maloy, John E Cronan Jr. and David Freifelder. Microbial Genetics, 2nd edition, Narosa publishing house, New Delhi. 2006. 2. David Frifelder. Molecular Biology, Narosa publishing house, New Delhi. 2nd edition. 2008. 3. Lodish H, Baltimore D, Berk A, Zipsury SL, Matsudaira P, Darnell J. Molecular Cell Biology. Scientific American Books. 1995.
Website Link	1. https://openstax.org/books/concepts-biology/pages/9-2-dna-replication 2. https://en.wikipedia.org/wiki/Transcription_(biology) 3. https://www.goodreads.com/book/show/30631594-freifelder-s-essentials-of-molecular-biology-4th-edition-pb

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3UMBC03	MICROBIAL GENETICS AND MOLECULAR BIOLOGY	DSC THEORY - III	III	5	5			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	M	S	M	M
CO2	S	S	S	S	S	M	M	S	M	M
CO3	S	S	S	S	S	S	M	S	M	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, PPT, Video presentation
Assesment Methods	Unit Test, Class Test, Assignment, Internal Examination, Model Presentation

Designed By	Verified By	Approved By
Dr.M.Sankareswaran	Dr.M.Selvan	A. h. Sam

MUTHAYAMMAL COLLEGE OF ARTS & SCIENCE
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637 408
Tamil Nadu

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M3UMBCP03	**Practical : Microbial Genetics**	**DSC PRACTICAL - III**	**III**	**3**	**-**	**-**	**3**	**2**
Objective	To understand molecular techniques used to isolation and identifications of biomolecules							

S.No.	**Course Content**	**Knowledge Levels**	**Sessions**
1	Observation of mitosis from onion root tip.	K1-K3	3
2	Isolation of Genomic DNA from Bacteria.	K2-K3	3
3	Isolation of Plasmid DNA from Bacteria.	K2-K3	3
4	Separation of DNA by Agarose gel Electrophoresis.	K2-K3	3
5	Isolation of Auxotrophic mutant by replica plate method.	K2-K3	3
6	Isolation of drug resistant mutants by gradient plate method.	K2-K3	3
7	Isolation of phage from Sewage	K2-K3	3
8	Transformation (Demonstration)	K2	2
9	Estimation of DNA by DPA method (Demonstration)	K2	2
Course Outcome	CO1: Remember the cell division in onion root tip.	K1	
	CO2: Understand the method of isolation and separation of DNA	K2	
	CO3: Apply the knowledge about the bacterial mutants.	K3	
	CO4: Apply the knowledge about isolation of bacteriophage.	K3	
	CO5: Apply the molecules transformation.	K3	

Learning Resources

Text Books	1. Atlas RM and Bartha R. Microbial Ecology: Fundamentals and Applications, 3rd Ed., Benjamin and Cummings Pub. Co. New York. 1993. 2. Rajan S. Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai. 2012. 3. Rajan S and Selvi Christy R. Experimental Procedures in Life Sciences. Anajanaa Book House, Chennai Monica Chees brough. District Laboratory Practice in Tropical Countries - Part I and II, 2nd edition, Cambridge University Press, New Delhi. 2011.
Reference Books	1. Betty A Forbes, Daniel F Sahm and Alice S Weissfeld. Bailey and Scott's Diagnostic Microbiology, Mosby Elsevier. 12th Edition. 2007. 2. Mackie and McCartney (2006) Practical Medical Microbiology, South Asia Edition. 14th edition. 3. James G Cappuccino and Natalie Sherman. Microbiology - A Laboratory Manual (4th edition).The Benjamin publishing company, New York. 1996.
Website Link	1. https://www.researchgate.net/publication/280111071_Microbiology_Microbial_Genetics_Molecular_Biology_and_Biochemistry 2. https://www.asmscience.org/content/book/10.1128/9781555817480 3.https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Book%3A_General_Microbiology_Lab_Manual_(Pakpour_and_Horgan)

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M3UMBCP03	Practical : Microbial Genetics		DSC PRACTICAL - III		III	3	-	-	3	2
CO-PO Mapping										
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	S	S	S	S	L	S	S	M
CO2	S	M	S	S	S	S	L	S	S	M
CO3	S	M	S	M	S	S	L	S	S	S
CO4	S	M	S	M	S	S	L	S	S	S
CO5	S	M	S	M	S	S	L	S	S	S
Level of Correlation between CO and PO	L-LOW				M-MEDIUM			S-STRONG		

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation
Assessment Methods	Model practical and ESE

Designed By	**Verified By**	**Approved By**
Mrs.S.Subana	Dr.M.Selvan	Dr. S. SHAHITHA

Curriculum Development Cell * MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M4UMBC04	IMMUNOLOGY AND IMMUNOTECHNOLOGY	DSC THEORY - IV	IV	6	3	2	-	4
Objective	Explain the structural components and functioning of immune systems							
Unit	**Course Content**						**Knowledge Levels**	**Sessions**
I	**Introduction of immune system:** History and scope of immunology, Innate immunity and acquired immunity, Phagocytosis. Haematopoeisis- Cells – Lymphocytes, B –cell, T- cell and Ag presenting cells (macrophage, Dendritic cell and Lymphocytes) - organs- primary and secondary lymphoid organs.						K1-K2	12
II	**Antigens and Antibodies:** Antigen -Properties of antigen, immunogen, Adjuvant, Hapten. Antibody- structure and types. Complement - classical and alternative pathways. Monoclonal antibodies (Hybridoma technology) and its applications.						K1-K2	12
III	**Auto immune diseases & Hypersensitivity:** Auto immune diseases - Types and mechanisms. Hypersensitivity reactions - types, Antibody mediated (Type- I, Type II, Type III) and Cell mediated (Type- IV).						K2	12
IV	**Hematology & Transplantation:** Immuno hematology, Blood group, Rh - incompatibilities. Transplantation Immunology - HLA Tissue Typing - mechanism of acceptance and rejection. Vaccines - Types, Immunization schedule.						K1-K3	12
V	**Antigen - Antibody reactions:** Definition and Diagnostic Techniques: Agglutination, Precipitation – ODD, IFT, Flocculation. Immuno electrophoresis - RIA- CFT- ELISA.						K3	12
Course Outcome	**CO1:** Remember the structural components and mechanisms of immune system.						K1	
	CO2: Understand the knowledge about the role of immune system.						K2	
	CO3: Explain the mechanism of various diseases associated in immune system						K2	
	CO4: Demonstrate the antigen- antibody interaction						K3	
	CO5: Analyze the graft rejection						K4	
Learning Resources								
Text Books	1. Madhavee Latha (2012). A Text book Immunology. First edition, S. Chand & Company Ltd, New Delhi. 2. Annadurai B (2008). Immunology and Immunotechnology. First edition, S. Chand & Company Ltd., New Delhi.							

	3. Kannan I (2007). Immunology. First edition, MJP Publishers, Chennai.
Reference Books	1. Kuby Immunology - Richard A Goldsby, Thomas J Kindt. Barbara A Osborne, (2000). Fourth edition, W H Freeman and company. New York. 2. Tizard K (1983). Immunology. An Introduction. Saunders college publishing, Philadelphia. 3. Raitt, IM (1988). Essentials of Immunology. ELBS- Blackwell Scientific Publishers, London.
Website Link	1. https://www.worldcat.org/title/kuby-immunology/oclc/41528664 2. http://www.imgt.org/IMGTeducation/Tutorials/ImmuneSystem/UK/the_immune _system .pdf 3. https://www.goodreads.com/book/show/21203443-textbook-of-immunology

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M4UMBC04	IMMUNOLOGY AND IMMUNOTECHNOLOGY	DSC THEORY - IV	IV	6	3	2	-	4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M	S	S	S	M	M
CO2	S	S	M	M	M	S	S	S	M	M
CO3	S	S	M	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	M	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved By
Dr.A.K.Saravanan	Dr.M.Selvan	

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M4UMBCP04	IMMUNOLOGY-PRACTICAL	DSC PRACTICAL - IV	IV	3	-	-	3	2

Objective	To know about various immunological diagnostic methods		
S.No.	**List of Experiments / Programmes**	**Knowledge Levels**	**Sessions**
1	Blood collection and plasma/serum separation	K1-K3	2
2	Blood grouping - Rh typing -cross matching	K1-K3	3
3	Examinations of Blood Cells (Demonstration) - a. Total Count- WBC b. Differential Count- RBC, Basophil, Lymphocyte, Monocyte, Neutrophil and Platelets	K2-K3	3
4	Agglutination reaction - a. Widal test-slide and tube test b. ASO test c. RA test d. CRP test e. Pregnancy test (Slide and Card test)	K2-K3	6
5	Precipitation reaction - a. Radial Immuno diffusion (RIA) b. Ouchterlony Double immune diffusion test (ODD) c. Counter Immuno electrophoresis (CIE)	K2-K3	6
6	Flocculation - RPR TEST	K2-K3	3
7	HIV - Tri Dot test, Hepatitis – Hepa card	K2-K3	3
8	ELISA-HIV/HBS Ag (Demonstration)	K2-K3	3
Course Outcome	**CO1:** Remember the blood, serum and antiserum terminology.	K1	
	CO2: Understand the knowledge about the blood grouping identification methods.	K2	
	CO3: Demonstrate the various immune reactions.	K3	
	CO4: Analyze the antigen antibody interaction.	K4	
	CO5: Evaluate the sample reading using instruments	K5	

Learning Resources

Text Books

1. Aneja KR (2005). Experiments Microbiology, Plant pathology and Biotechnology. Fourth edition, New Age International Publishers, Chennai.
2. Dubey RC and Maheswari DK (2004). Practical Microbiology First edition, S Chand and Company Ltd., New Delhi.
3. Kannan N (2003). Handbook of laboratory culture media, Reagents, Stains and buffers. Panima Publishing Corporation, New Delhi.

Reference Books	1. Betty A Forbes, Daniel F Sahm and Alice S Weissfeld. Bailey and Scott's Diagnostic Microbiology, Mosby Elsevier. 12th Edition. 2007. 2. Mackie and McCartney (2006) Practical Medical Microbiology, South Asia Edition. 14th edition. 3. Mukherjee, L. (1997). Medical Laboratory Technology. Volume I & II. Tata McGrew- Hill Publishing Company Limited, New Delhi
Website Link	1. https://www.researchgate.net/publication/280733624_A_TEXT_BOOK_OF_IMMUNOLOGY_AND_IMMUNOTECHNOLOGY 2. https://www.academia.edu/14724561/A_TEXT_BOOK_OF_IMMUNOLOGY_AND_IMMUNOTECHNOLOGY 3.https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Book%3A_General_Microbiology_Lab_Manual_(Pakpour_and_Horgan)

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M4UMBCP04	IMMUNOLOGY-PRACTICAL	DSC PRACTICAL - IV	IV	3	-	-	3	2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	S	S	M	S	S	L
CO2	S	S	M	S	S	S	M	S	S	L
CO3	S	S	M	S	S	S	M	S	S	L
CO4	S	S	S	S	S	S	M	S	S	L
CO5	S	S	S	S	S	S	M	S	S	L

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, and Video presentation
Assessment Methods	Model practical and ESE

Designed By	Verified By	Approved By
Dr.A.K.Saravanan	Dr.M.Selvan	

Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M5UMBC05	**MEDICAL BACTERIOLOGY AND MYCOLOGY**	**DSC THEORY - V**	V	6	4	2	-	5
Objective	To understand the characteristics of various bacteria and fungi in medical oriented.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Infections and Carriers**: Infections – source of infections, Types of infections – methods and transmission of infections. Definitions – endemic, epidemic, pandemic, acute, chronic, systemic and opportunistic diseases. Virulence factors of Bacteria. Normal flora of human beings.	K1-K2	12
II	**Gram Positive Bacteria:** Morphology, Pathogenicity, Biochemical, laboratory diagnosis and prevention of bacterial diseases – *Stphylococccus aureus, Streptococcus pyogenes, S. Pneumonia, Neisseria gonorrhoeae, Bacillus anthracis, Corynebacterium diphtheriae, Clostridium tetani* and *Mycobacterium tuberculosis*.	K3	12
III	**Gram Negative Bacteria:** Morphology, Pathogenicity, biochemical, laboratory diagnosis and prevention of bacterial diseases - *Salmonella typhi, Shigella dysentriae, Vibrio cholera, E. coli, Proteus vulgaris, Klebsiella sps, Pseudomonas aeruginosa – Treponema palladium, Leptospira interrogans, Mycoplasma pneumonia.*	K4	12
IV	**Introduction to Medical Mycology** – Morphological features of fungi – Classification of medically important fungi, Lab Diagnosis of fungal infections. Superficial mycosis – *Pityriasis versicolor*, *Tinea nigra*. Cutaneous mycosis – Dermatophytosis. Subcutaneous mycosis – Sporotrichosis, *Mycetoma.*	K3	12
V	**Systemic and Opportunistic Mycosis:** Systemic mycosis – Blastomycosis, Histoplasmosis, Coccidioidomycosis. Opportunistic mycosis – Candidiasis, Cryptococcosis, Aspergillosis. Antifungal agents and Sensitivity tests.	K4	12
Course Outcome	**CO1:** Remember about the sources of various infections and their occurrence.	K1	
	CO2: Understand the knowledge about the characteristics of gram positive bacteria.	K2	
	CO3: Analyze the information on the characteristics of gram negative bacteria.	K4	
	CO4: Apply the knowledge about medically important fungi.	K3	
	CO5: Survey the information on medically important fungi	K4	

Learning Resources	
Text Books	1. Chakraborty P (2013). A text book of Microbiology. 3rd edition. New central agency (P) Ltd., Kolkata. 2. Ananthanarayan R and Jayaram Paniker CK (2020). Text book of Microbiology. 11th edition. Orient Longman Limited, Hyderabad.

Reference Books	1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers. 2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall 3. Madigan MT, and Martinko JM. (2006). Brock Biology of Micro-organisms. 8th edition. Parker J. Prentice Hall International, Inc. 4. PelczarJr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition Tata McGraw Hill.			
Website Link	1. https://microbiologysociety.org/members-outreach-resources/links.html 2. http://textbookofbacteriology.net/nd 3. https://www.isham.org/mycology-resources/mycological-links			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	**Course Title**			**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M5UMBC05	**MEDICAL BACTERIOLOGY AND MYCOLOGY**			**DSC THEORY - V**		V	6	4	2	-	5
CO-PO Mapping											
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	S	S	S	S	M	S	S	S	S	S	
CO2	S	S	S	S	M	S	S	S	S	S	
CO3	S	S	S	S	S	S	S	S	S	S	
CO4	S	S	S	S	S	S	S	S	S	S	
CO5	S	S	S	S	S	S	S	S	S	S	
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG		

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app,	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation, Poster Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By**
Dr.S.Anbalagan	Dr.M.Selvan	Dr. S.SHAHITHA

Curriculum Development Cell MCAS (Autonomous) Alastipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M5UMBC06	FOOD AND INDUSTRIAL MICROBIOLOGY	DSC THEORY - V	V	6	4	2	-	5
Objective	To understand the applications of microorganisms in Food and Industrial Microbiology.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Food Microbiology:** Microorganisms and their importance in the food microbiology – molds, yeast, bacteria. Factors influencing microbial growth in food - extrinsic and intrinsic factors. Food preservation: principles and methods of food preservation, asepsis, control of microorganism, anaerobic condition, high temperature, low temperature, drying, radiation and chemical preservation.	K1-K3	12
II	**Food Contamination and Spoilage:** Contamination and spoilage of Cereals, Vegetables, Fruits, Fish, Poultry and Canned foods, detection of spoilage and characterization. Food borne diseases: Food poisoning and food borne diseases: Bacterial toxins and mycotoxins in food.	K2-K3	12
III	**Fermentor and Fermentation:** Definition, Design and types of fermentor – Air lift, fluidized bed, stirred, Tower fermentor. General consideration of fermentation process, types of fermentation-submerged and solid state.	K2-K3	12
IV	**Scale up and Scale down process:** Screening and selection of industrially important cultures. Inoculum development, strain improvement and downstream processing.	K2-K3	12
V	**Commercial production:** Commercial fermentation products. Enzymes - Protease, Amylase. Organic solvents – Ethanol. Acids – Acetic acid and Lactic acid. SCP – BGA. Vitamins -Vit B12. Amino acids - Glutamic acid. Antibiotics – Penicillin and Streptomycin.	K3-K5	12
Course Outcome	**CO1:** Remember about the different parameters in microbial growth and its preservation.	K1	
	CO2: Understand the knowledge on the growth pattern and spoilage in food sources.	K2	
	CO3: Apply the instrumental approaches in food industry.	K3	
	CO4: Develop the media formulations in food industry.	K3	
	CO5: Apply and evaluate the microorganisms in industrial production.	K5	

Learning Resources	
Text Books	1. Sivashankar B - Moss (2011). Food Processing and Preservation. Eighth edition, PHI Learning P.Ltd., New Delhi. 2. Sivakumar PK, Joe MM and Sukesh K (2010). An introduction to Industrial Microbiology. First edition, S. Chand & Company Ltd, New Delhi.

Reference Books	1. Vijaya Ramesh K (2007). Food Microbiology. First edition, MJP Publishers, Chennai. 2. Adams MR - Moss (2004). Food Microbiology Second edition, Panima publishing house New Delhi 3. Patel AH (2005). Industrial microbiology. Published by Mac Millan India Ltd., Chennai. 4. Stanbury PF, Whitaker A and Hall SJ (1997). Principles of Fermentation Technology. Second edition, Pergmon Press
Website Link	1. https://www.in.gov/health/laboratories/environmental-microbiology/ 2. https://ajph.aphapublicatio..s.org/doi/book/10.2105/MBEF.0222

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M5UMBC06	FOOD AND INDUSTRIAL MICROBIOLOGY	DSC THEORY - V	V	6	4	2	-	5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app,
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved By
Mr.N.Radhakrishnan	Dr.M.Selvan	Dr. S.SHAHITHA

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M5UMBP05	**PRACTICAL: MEDICAL MICROBIOLOGY, FOOD AND INDUSTRIAL MICROBIOLOGY**	**DSC PRACTICAL - V**	**V**	**3**	**-**	**-**	**3**	**2**
Objective	To learn about the microbial identification methods and industrial approach							

S.No.	**Course Content**	**Knowledge Levels**	**Sessions**
1	Staining techniques - Gram's, Ziehl - Neelsen, Capsular, and Spore staining.	K1-K5	6
2	Biochemical identification of the following bacterial pathogens : Indole, MR, VP, Citrate, TSI, Urease, Catalase & Oxidase test for *a. Staphylococcus aureus* *b. Escherichia coli* *c. Klebsiella pneumoniae* *d. Salmonella typhi* *e. Proteus vulgaris* *f. Pseudomonas aeruginosa*	K2-K5	6
3	Normal saline/Lugol's iodine preparation for parasitic Ova/cyst examination.	K2-K5	3
4	Stool examination by Zinc-Sulphate floatation method.	K2-K5	3
5	Blood smear examination for malarial parasite (*Plasmodium falciparum)*	K2-K4	3
6	Examination of fungi by KOH and Lactophenol cotton blue stain.	K2-K5	3
7	Examination of *Candida albicans* by Gram's stain, Germ tube.	K2-K4	3
8	Examination of *Cryptococcus neoformans* by Negative staining.	K2-K4	3
9	AST – Kirby-Bauer disc diffusion method.	K2-K5	3
10	Standard plate count technique (SPC) Milk and Yogurt.	K3	3
11	Methylene Blue Reduction test (MBRT), Resazurin test.	K5	3
12.	Microbial production of alcoholic Beverages - Wine (Demo)	K3	3
Course Outcome	**CO1:** Remember the methods of isolation of bacteria.	K1	
	CO2: Understand the basic identification of fungi and parasites.	K2	
	CO3: Apply the various biochemical methods in identification of bacteria.	K3	
	CO4: Compare the knowledge of pharmaceutical and food industrial approach.	K4	
	CO5: Assess the microorganisms in food and industrial products.	K5	
Learning Resources			

Text Books	1. Aneja KR (2017). Experiments in Microbiology, Plant pathology and Biotechnology. 5th Edition, New Age International Publishers, Chennai. 2. Sundararaj T. Microbiology laboratory manual. Revised and published by Aswathy Sundararaj. No.5 First Cross Street, Thirumalai Nagar, Perungudi, Chennai.
Reference Books	1. James G Cappuccino and Natalie Sherman (2007). Microbiology: A laboratory manual. 8th edition, Published by Pearson Education. 2. Kannan N (2002). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. Tamil Nadu. 3. Harold J Benson (2006).Microbiological Applications Laboratory Manual in General Microbiology. 10th International edition, Me Grew - Hill, Boston.
Website Link	1. https://onlinecourses.swayam2.ac.in/cec20_ag09/preview 2. https://onlinelibrary.wiley.com/doi/book/10.1002/0471223867 3.https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Book%3A_General_Microbiology_Lab_Manual_(Pakpour_and_Horgan)

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M5UMBP05	PRACTICAL: MEDICAL MICROBIOLOGY, FOOD AND INDUSTRIAL MICROBIOLOGY	DSC PRACTICAL - V	V	3	-	-	3	2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation
Assessment Methods	Model practical and ESE

Designed By	Verified By	Approved By
Dr.S.Anbalagan & Mrs.N.Sathyabama	Dr.M.Selvan	Dr.S.SHAHITHA

Development Cell MCAS (Autonomous) Rasipuram

B.Sc Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M5UMBIS1	**INTERNSHIP**	**INTERNSHIP**	**V**	-	-	-	-	-
Objective	To give optimum exposure on the practical applications of Microbiology in industries							

S. No.	Guidelines for Internship Training Programme	Knowledge Levels	Sessions
1	The student should undergo **15 Days Internship** training in any Microbiology lab/ Food industry / Poultry farm / Water plant / Biofertilizer industry during the vacation which falls at the end of the 4th Semester.	K2-K4	
2	The training bridges the gap between the theoretical knowledge gained in the college and the practical application of the same in the industry / company / Lab. The student will have a better exposure about the workplace and its nuances.		
3	Schedule of visit to be made by the staff is to be prepared by the HOD / Staff-in-charge.		
4	The trainees should strictly adhere to the rules and regulations and office timings of the institutions to which they are attached.		
5	A Staff member of a Department (Guide) will be monitoring the performance of the Candidate.		
6	The students should maintain a daily logbook where the student should record his details of the training.		
7	The trainees have to obtain a certificate on successful completion of the internship from the chief executive of an organization.		
8	The student should submit an attendance certificate to the institution for 15 days internship training from the organization.		
9	Internship Training Report (30 – 50 pages) should be prepared by the student and submitted in a month time and at the end of the semester student should present the report with a power point presentation.		
10	Industrial training reports shall be prepared by the students under the supervision of the faculty of the department.		
11	Industrial training report must contain the following: Cover page Copy of training certificate, Profile of an industry report about the work undertaken by them during the tenure of training observation about the concern findings.		
12	Practical viva – voce examination will be conducted with internal & external examiners at the end of the **5th semester** and the credits will be awarded.		
13	Report Evaluation: External Viva-Voce examination will be conducted and the maximum mark is 100.		

Course Outcome	**CO1:** Apply new techniques and ideas of Microbiology in industries	K3
	CO2: Analyze the results of new initiatives	K4
	CO3: Create a new work plan with greater output	K6
	CO4: Create a framework of work execution ideas	K6
	CO5: Create a detailed technical work plan and terminologies to be followed in industries/Laboratory.	K6

Learning Resources

Text Books	1. The Successful Internship by H. Frederick Sweitzer, Mary A. King, 2013. 2. Social Media Tools in Experiential Internship Learning by Samuel Kai Wah Chu, 2020.
Reference Books	1. The Intern Files: How to Get, Keep and Make the Most of Your Internship by Jamie Fedorko, 2006.
Website Link	1. http://gen.lib.rus.ec/

B. Sc - Microbiology LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M5UMBIS1	INTERNSHIP	INTERNSHIP	V	-	-	-	-	-

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	S	M	S	S	S	S
CO2	S	M	S	S	S	S	M	S	S	S
CO3	M	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	S	S	M	S	S	S
CO5	M	S	S	S	S	M	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Follow the SOP of the industries/Laboratory
Assessment Methods	**CIA – 100 Marks** 1. Work Log Book – 25 Marks 2. Training Report and Viva-Voce – 75 Marks

Designed By	Verified By	Approved By
Mr.N.Radhakrishnan	Dr. M.Selvan	

08/8/23

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Assistant Professor and Head
Department of Microbiology
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Curriculum Development Cell
MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M6UMBC07	**AGRICULTURAL MICROBIOLOGY AND PLANT PATHOLOGY**	**DSC THEORY - VII**	V	5	5	-	-	5
Objective	To understand the soil microorganism in sustainable agriculture.							
Unit	**Course Content**						**Knowledge Levels**	**Sessions**
I	**Soil microbes and biogeo chemical cycles**: Microbial communities, significance of soil microbes. Autochthonous, allothonous and Zymogenous. Factors influencing the soil microbial population. Biogeochemical cycle – Carbon, Nitrogen, Phosphorous and Sulphur.						K1-K2	10
II	**Biological nitrogen fixation**: Nitrogen fixers – types –*Rhizobium*, Symbiotic nitrogen fixation. Root nodule formation. Structure of nodule & biochemistry of Nitrogen fixation, Nitrogenase, Nitrogen fixation in Cyanobacteria - Heterocyst. *Frankia*						K2-K3	10
III	**Microbial interactions**: Commensalism, Synergism, Mutualism, Amensalism, Competition, Parasitism and Predation. Interaction of microbes with plants: Rhizosphere, Phyllosphere, Mycorrhizae. Rumen flora. Insect symbiosis.						K1-K3	14
IV	**Plant pathology**: symptoms, characters of pathogens, disease cycle and control measures: Bacterial diseases – Citrus canker, Blight of rice. Fungal diseases – Red rot of sugarcane, Tikka leaf spot of ground nut. Rust of wheat, Viral diseases - Vein clearing disease of Bhendi, Little leaf of Brinjal,						K1-K3	12
V	**Biofertilizers and Biopesticides**: Classification, Mass cultivation and field application – *Rhizobium, Azotobacter*, Phosphate solubilizers, potash mobilizers (*Frateuria aurentia*), VAM, *Azolla*. Biopesticides: classification, mode of action - Bacterial insecticides (*Bacillus thuringiensis*) and Viral insecticides (NPV) and *T. viride*.						K1-K4	14
Course Outcome	**CO1:** Remember about the basic nutritional requirements of soil microorganisms.						K1	
	CO2: Understand the knowledge of nitrogen fixation by soil microbes.						K2	
	CO3: Apply the knowledge of microbial interaction with living system.						K3	
	CO4: Analyze the plant disease and their control measures.						K4	
	CO5: Analyze the microbial products in agriculture.						K4	

Learning Resources				
Text Books	1. SubbaRao NS (2004). Soil Microbiology. Fourth edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. 2. Mishra RR (2004). Soil Microbiology. First edition, CBS Publishers and distributors, New Delhi			
Reference Books	1. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. Fourth edition, PHI Learning (P) Ltd., New Delhi. 2. Rangaswami G and Bagyaraj DJ (2002). Agricultural Microbiology. Second edition, PHI Learning (P) Ltd., New Delhi. 3. Robert, L Tate (2020). Soil Microbiology. 3rd edition, John Wiley and Sons, Inc. New York. 4. Sharma, P.D. (2018), Plant Pathology. Second Edition. Rastogi Publications.			
Website Link	1. https://agriculture.nagaland.gov.in/bio-fertilizer/ 2. https://www.india.gov.in/topics/agriculture/organic-farming 3. https://vlab.amrita.edu/index.php?sub=3&brch=272			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	**Course Title**			**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M6UMBC07	**AGRICULTURAL MICROBIOLOGY AND PLANT PATHOLOGY**			**DSC THEORY - VII**		**VI**	5	5	-	-	5
CO-PO Mapping											
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	S	M	S	M	M	S	M	M	M	S	
CO2	S	M	S	M	M	S	M	M	S	S	
CO3	S	M	S	S	S	S	S	M	S	S	
CO4	S	S	S	S	S	S	S	S	S	S	
CO5	S	S	S	S	S	S	S	S	S	S	
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG		

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app,
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By**
Mrs.N.Sathyabama	Dr.M.Selvan	Dr. S.SHAHITHA

Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M6UMBC08	**ENVIRONMENTAL MICROBIOLOGY AND BIODEGRADATION**	**DSC THEORY - VIII**	**VI**	5	5	-	-	5
Objective	To understand the microorganisms are applied in various environments.							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Air Microbiology**: Microbiology of air - Enumeration of bacteria from air - Air sampling devices - Air sanitation - Air borne diseases.	K1-K3	10
II	**Water Microbiology**: Aquatic microbiology: Ecosystem-fresh water (ponds, lakes and streams). Marine water ecosystem. Microbiology of water - Potability of water - MPN technique – microbial assessment of water quality. Indicator organisms - Water purification - Water borne diseases and their control measures.	K2-K4	12
III	**Waste Water Treatment**: Microbiology of sewage- chemical and biochemical characteristics of sewage - BOD and COD – Sewage treatment - physical, chemical & biological - aerobic and anaerobic (trickling filter, activated sludge and oxidation pond) treatment-disposable of wastes.	K1-K4	13
IV	**Biodegradation:** Biodegradation of lignin, cellulose and dye. Xenobiotics compounds - Degradation of pesticides (DDT, BHC and malathion). Biodeterioration - leather, paint. Oil degradation - *P. putida*. Biotechnological methods for hazardous waste management.	K1-K3	13
V	**Bioremediation:** Definition - constraints and priorities of bioremediation. Bioaugmentation; bioreactors for remedial processes, types of bioremediation- in situ & ex situ. Bioleaching – copper, silver, and uranium. Biosensors	K1-K3	12
Course Outcome	**CO1:** Remember about the isolation of air borne microorganisms.	K1	
	CO2: Understand the knowledge about water borne microorganism and assessment of water quality.	K2	
	CO3: Apply the methods for waste water treatment.	K3	
	CO4: Apply the methods for biodegradation in environment.	K3	
	CO5: Analyze the bioremediation and biomines.	K4	

Learning Resources	
Text Books	1. Vijaya Ramesh K (2019). Environmental Microbiology First edition, MJP publishers (a UNIT of Tamil Nadu book house), 2. Joseph C Daniel (1999). Environmental aspects of Microbiology. First edition, Bright Sun Publications, Chennai.

Reference Books	1. Mitchell R (1974). Introduction to Environmental Microbiology. Prantice Hall. Inc., Englewood Cliffs, New Jersey. 2. Murugesan AG and Rajakumari C (2005). Environmental Science and Biotechnology. First Edition, MJP Publishers, Chennai. 3. Singh DP and Dwivedi SK (2005). Environmental Microbiology and Biotechnology. First edition, New Age International (P) Ltd., New Delhi. 4. Atlas, R.M. and Bartha, R (1997). Microbial Ecology, Fundamental and Application, 4th Edition, Bengamin and Cummings
Website Link	1. https://www.kopykitab.com 2. https://www.intechopen.com 3. https://www.in.gov/health/laboratories/environmental-microbiology 4. https://ajph.aphapublications.org/doi/book/10.2105/MBEF.0222

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M6UMBC08	ENVIRONMENTAL MICROBIOLOGY AND BIODEGRADATION	DSC THEORY - VIII	VI	5	5	-	-	5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app,
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved By
Dr.M.Selvan	Dr.M.Selvan	Dr. S.SHAHITHA

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M6UMBP06	**PRACTICAL: AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY**	**DSC PRACTICAL - VI**	**VI**	**3**	**-**	**-**	**3**	**2**
Objective	To learn about the basic physiological factors and bacterial identification methods							

S.No.	Course Content	Knowledge Levels	Sessions
1	Examination of plant diseases – Blight of rice, Citrus canker, Red rot of sugarcane, Wilt of cotton and Tikka leaf spot, Rust in ground nut.	K1-K4	6
2	Enumeration of bacteria and fungi from soil.	K2-K3	3
3	Isolation of Nitrogen fixing bacteria from root nodules of legumes.	K2-K4	3
4	Isolation of *Azospirillum* and *Azotobacter* from Rhizosphere soil.	K2-K3	6
5	Isolation of Phyllospheric microorganism	K2-K4	3
6	Morphological study of Cyanobacteria – *Oscillatoria*, *Anabaena*.	K2-K4	3
7	Examination of Mycorrhizae in Maize roots.	K2-K4	3
8	Demonstration of phosphate solubilization.	K2	3
9	Most Probable Number (MPN) test.	K2-K4	3
10	Enumeration of Microbes from water – Membrane filter	K3	3
11	Enumeration of Microbes from air by settle plate method and air sampling device	K2-K4	3
12	Paper and Thin layer chromatography –Amino acids.	K4	6
13	Production of Mushroom Spawn with grains	K1 - K4	3
14	Production of Oyster mushroom with paddy straw (Demo)	K1 - K4	3
15	Mass cultivation of *Azolla*	K1 - K4	3
16	Cultivation of *Spirulina* (Demonstration)	K1 - K4	3
Course Outcome	CO1: Remember the isolation of soil microbes and plant pathogens.	K1	
	CO2: Understand the isolation of beneficial soil and air microbes.	K2	
	CO3: Identify the various methods of water quality assessment.	K3	
	CO4: Compare the amino acid separation methods.	K4	
	CO5: Inspect the mass cultivation of macro fungi and algae.	K4	
Learning Resources			

Text Books	1. Aneja KR (2017). Experiments in Microbiology, Plant pathology and Biotechnology. 5th Edition, New Age International Publishers, Chennai. 2. Sundararaj T. Microbiology laboratory manual. Revised and published by A Swathy Sundararaj. No.5 First Cross Street, Thirumalai Nagar, Perungudi, Chennai.
Reference Books	1. James G Cappuccino and Natalie Sherman (2007). Microbiology: A laboratory manual. Sixth edition, Published by Pearson Education. 2. Kannan N (1996). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. Tamil Nadu. 3. Harold J Benson (2006).Microbiological Applications Laboratory Manual in General Microbiology. Tenth International edition, Me Grew - Hill, Boston.
Website Link	1. https://www.frontiersin.org/books/Microbial_Physiology_and_Metabolism 2. https://onlinelibrary.wiley.com/doi/book/10.1002/0471223867 3.https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Book%3A_General_Microbiology_Lab_Manual_(Pakpour_and_Horgan)

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M6UMBP06	PRACTICAL: AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY	DSC PRACTICAL - VI	VI	3	-	-	3	2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation	
Assessment Methods	Model practical and ESE	
Designed By	**Verified By**	**Approved By**
Dr.M.Selvan & Mrs.N.Sathyabama	Dr.M.Selvan	Dr. S.SHAHITHA

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc., Microbiology LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M6UMBPR1	PROJECT WORK	PROJECT WORK	VI	3	-	-	3	5
Objective	To inculcate/impart skills on experiment designing, experiment execution and research report to provide skills on writing Project report and dissertation.							
Details	**Course Content**						**Knowledge Levels**	**Sessions**
PROJECT PREPARATION FORMAT								
Cover Page & Title Page	**Cover Page & Title Page:** The fonts and locations of various items on this page should be exactly as shown in a specimen copy.							
Inside cover page	Inside cover page Same as cover page.							
Bonafide Certificate	**Bonafide Certificate**: The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14.							
Acknowledgement	**Acknowledgement:** This should not exceed one page.							
Abstract	**Abstract:** Abstract should be one page synopsis of the project report typed double line spacing, Font Style Times New Roman and Font Size 14.							
Contents	**Table of Contents:** The table of contents should list all headings, sub headings after the table of contents page, as well as any titles preceding it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents. One and a half spacing should be adopted for typing the matter under this head.							
Tables	**List of Tables**: The list should use exactly the same captions as they appear above the tables in the text. 1.5 spacing should be adopted for typing the matter under this head.							
Figures	**List of Figures**: The list should use exactly the same captions as they appear below the figures in the body of the text. One and a half spacing should be adopted for typing the matter under this head. All charts, graphs, maps, photographs and diagrams should be designated as figures. X and Y axes titles are mandatory for all the graphs.							
Symbols	**List of Symbols, Abbreviations and Nomenclature:** 1.5 spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.							
Chapters	**Chapter I - Introduction:** Statement of the Problem, Significance, Need for the study, Objectives							
	Chapter II- Review of literature							
	Chapter III- Methodology: Tools used, Procedures, Hypothesis.							

	Chapter IV- Results and Discussion: Tables and Figures, Statistical Presentations, Hypothesis Testing.		
	Chapter V- Summary and conclusion		
	Chapter VI- Scope of the Project/ Futurology		
	References		
Guidelines For Project Preparation			
Numbering	• Every page in the project report, except the project report title page, must be accounted for and numbered. • The page numbering, starting from acknowledgements and till the beginning of the introductory chapter, should be printed in small Roman numbers, ie, i, ii, iii, iv. • The page number of the first page of each chapter should not be printed (but must be accounted for). All page numbers from the second page of each chapter should be printed using Arabic numerals, i.e. 2,3,4,5. • All printed page numbers should be located at the right corner at the bottom of the page.	K4-K6	
Chapters	• Use only Arabic numerals. Chapter numbering should be centered on the top of the page using large bold print. <Size 14><Times New Roman>	K4-K6	
TEXT			
Regular Text	**Regular Text**: Times Roman 12 pts and normal print.	K4-K6	
Chapter Heading	**Chapter Heading** - Times Roman 14 pts. Bold and capital.	K4-K6	
Section Headings	**Section Headings** - Times roman 12 pts. Bold and capital.	K4-K6	
Subsection Headings	**Subsection Headings** - times roman 12 pts. bold print and Leading capitals ie, only first letter in each word should be in capital.	K4-K6	
Special Text	**Special Text**- Italics/Superscript /Subscript/Special symbols, etc., as per necessity. Special text may include footnotes, endnotes, physical or chemical symbols, mathematical notations, etc.	K4-K6	
Sections	**Sections:** Use only Arabic numerals with decimals. Section numbering should be left justified using bold print. Example: 1.1, 1.2, 1.3, etc.	K4-K6	
Sub Sections	**Sub Sections:** Use only Arabic numerals with two decimals. Subsection numbering should be left Justified using bold print. Example: 1.1.1, 1.1.2, 1.1.3, etc.	K4-K6	
References	Use only Arabic numerals. Serial numbering should be carried out based on Alphabetical order of surname or last name of first author. The format is written like, author name followed by year followed by title of the work followed by details of the journal. Same font as regular text, serial number and all authors names to be in bold print. Title and Journal names should be in italics.	K4-K6	

	One Author: Williams, G. State and Society in. Onco State, Nigeria, Afrographika, 1980. Two Authors: Phizacklea, A & Miles, R. Labour and Racism. London, Routledge & Kegan Paul, 1980. 3+ Authors: O'Donovan, P., et al. The United States. Amsterdam, Time-Life International, 1966.		
Typing Instructions	**Typing Instructions:** The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style 'Times New Roman' and Font size 12. Use A4 (210 mm X 297 mm) bond un-ruled paper (80 gsm) for all copies submitted. Use one side of the paper for all printed/typed matter.	K4-K6	
Justification	**Justification:** The text should be fully justified	K4-K6	
Margins	**Margins:** The margins for the regular text are as follows LEFT - 1.5" RIGHT - 1" TOP - 1" BOTTOM - 1"	K4-K6	
Paragraph Spacing	Use 6 pts before & 6 pts after paragraphs. All paragraphs in the seminar/project report should be left justified completely, from the first line to the last line. Use 1.5 spacing between the regular text and quotations. Provide double spaces between: (a) From top of page to chapter title, (b) Chapter title and first sentence of a chapter, Use single spacing (a) In footnotes and endnotes for text. (b) In explanatory notes for tables and figures. (c) In text corresponding to bullets, listings, and quotations in the main body of seminar/project report. (d) Use single space in references and double space between references.	K4-K6	
Tables	All tables should have sharp lines, drawn in black ink, to separate rows/columns as and when necessary. Tables should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including tables on a page, should be avoided. Provide double spaces on the top and the bottom of all tables to separate them from the regular text, wherever applicable. The title of the table etc. should be placed on the top of the table. The title should be centered with respect to the table. The titles must be in the same font as the regular text and should be single spaced.	K4-K6	

Figures	All figures, drawings, and graphs should be drawn in black ink with sharp lines and adequate contrast between different plots if more than one plot is present in the same graph. The title of the figure etc. should be placed on the bottom of the figure. Figures should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including figures on a page, should be avoided. Provide double spaces on the top and the bottom of all figures to separate them from the regular text, wherever applicable. Figures should be centered with respect to the figure. The titles must be in the same font as the regular text and should be single spaced. The title format is given below: Fig. <blank><chapter number>.<serial number><left indent><figure	K4-K6	
Page Dimension & Binding Specifications	The project report should be prepared in A4 size. The dissertation shall be properly bound; The bound front cover should indicate in Silver and embossed letter.		
Course Outcome	**Co:1** Identification of Basic applied research ideas	K4	
	Co:2 Analyze of problem solving skills	K4	
	Co:3 Analyze sources for conduct of Research	K4	
	Co:4 Evaluate the research report	K5	
	Co:5 Create the research report	K6	
Learning Resources			
Text Books	1. Research Methodology: Methods and Techniques, by N.Gurumani, MJP Publishers, 2011.		
Reference Books	1. Research Methodology: Methods and Techniques by C.R. Kothari, New Age Publications, 1985. 2. Essentials of Research Design and Methodology by: Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005.		
Website Link	1. http://gen.lib.rus.ec/		

B. Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M6UMBPR1	PROJECT WORK	PROJECT WORK	VI	3	-	-	3	5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	M	M	L	S	L	M	S	S	S
CO2	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	S	S	S	S	M	M
CO4	S	S	S	M	S	S	S	S	M	M
CO5	M	M	M	S	S	M	M	S	L	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Application of Microbiology Knowledge and ideas in Basic Research
Assessment Methods	**EA - 100%** 1. Project Report - 60 Marks 2. Viva-Voce - 40 Marks 3. Total - 100 Marks

Designed By	Verified By	Approved By
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Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc., Microbiology for Competitive Examination Syllabus-LOCF-CBCS-Pattern with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M6UMBOE1	**Microbiology for Competitive Examination**	**Self study Online -Competitive Examination**	**VI**	**-**	**-**	**-**	**-**	**2**
Objective	Creating the awareness on competitive examination among students. Imparting knowledge about appearing for Competitive Examination and it impacts and developing an attitude for appearing such Examinations.							

	Course Content	**Knowledge Levels**	**Session**
	Assemblage of different papers related to Microbiology in particular, General Microbiology, Immunology, Bacteriology, Mycology, Virology, Food, Dairy, Environmental and Agri. Microbiology etc., Major emphasis has been put forth to include recent developments in the subjects. This course aims to give a holistic view of all the topics which comprised of some factual text points, multiple choice questions (MCQ), it is extremely suitable for students pursuing their higher degree in University/institute for their entrance exams, students preparing for various national and state level competitive entrance exams for higher studies. Getting job in various fields such as Food and Dairy Industries, Pharma Companies, Water treatment plants, Clinical Laboratory and Blood Bank etc., In addition, it is also useful for UPSC and PSC. **Rules for creating MCQ pattern.** 1. Objective type online examination will be conducted at the end of 6th semester. 2. Questions must be taken from all previous question papers of UPSC, PSC and University Common Entrance test for higher studies. 3. **Test for critical thinking.** Multiple choice questions to test the superficial knowledge. Learners to interpret facts, evaluate situations, explain the causes and effect, make inferences, and predict the results. 4. **Emphasize for Higher-Level Thinking** Use memory-plus, application oriented questions. These questions require students to recall the principles, rules and facts in a real life context. **Eg.1** Ability to Justify Methods and Procedures Why is adequate lighting necessary in a balanced aquarium? a. Fish need light to see their food. b. Fish take in oxygen in the dark.	K1- K6	

	c. Plants expel carbon dioxide in the dark. d. Plants grow too rapidly in the dark. **Eg.2** Ability to Interpret Cause-and-Effect Relationships What does a viral DNA becomes after being associated with the bacterial chromosome? a) plasmid b) plaque c) prophage d) gene **5. Mix up the order of the correct answers** Keep correct answers in random positions and don't let them fall into a pattern that can be detected 6. **Use a Question Format** Multiple-choice items to be prepared as questions (rather than incomplete statements) Incomplete Statement Format: The capital of California is in Direct Question Format------ Less Effective. In which of the following city is the capital of California? This is Best format. 7. **Keep Option Lengths Similar** Avoid making your correct answer the long or short answer 8. **Avoid the "All the Above" and "None of the Above" Options** Students merely need to recognize two correct options to get the answer correct 9. HOD's instruct to the faculty to prepare minimum 500 questions booklet (cumulatively for each programme) with solutions and circulate among the students.	
Course Outcome	**CO1:** Students will remember the advanced biochemical and molecular techniques.	K1
	CO2: Students will be able to understand the basic rules and the concepts.	K2
	CO3: To be able to apply in real life situations.	K3
	CO4: To analyze and create the new ideas for various competitive examinations.	K4-K5
	CO5: To assess forms and levels of critical thinking.	K2

Text Books	1. Tortora, G.J., Funke, B.R. and Case, C.L. (2016) Microbiology: An Introduction, 11th Edition, Pearson Education, India.		
	2. Owen,J., Punt,J and Strand ford, S."Kuby Immunology", 7th Ed., W.H.Freeman Publication, NewYork, USA, 2012.		
	3. Watson JD, Hopkins NH, Roberts JW et al. (1987) Molecular Biology of the Gene, 4th edn. Menlo Park, CA: Benjamin-Cummings		
	4. Brown, T.A. 1995.Gene Cloning–An Introduction. [Third Edition]. Chapman and Hall, UK.		
	5. MCQ'S IN MICROBIOLOGY: ADVANCED by Balaram Mohapatra., 2019.		
Reference Books	1. Chetan D. M., Dr. S. Nanjunda Swamy, (2021). Microbiology Multiple-Choice Questions (Mcqs) For Neet and Net Examinations.		
Website Link	https://www.ugc.ac.in/old pdf /model curriculum/env.pdf https://swayam.gov.in/nc_details/NPTEL		

CO - PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	M	S	S
CO2	S	M	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	M	S	S	S	S
CO4	S	S	S	S	S	S	S	S	M	S
CO5	S	S	S	S	M	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG
Tutorial Schedule	CET/TRB/TNPSC/Bank/ Railway, Old question papers – solutions –online mock test		
Teaching and Learning Methods	Self study, Group discussion, Chalk and Talk, Audio-Video Learning, learning through mock test and experienced learning		
Assessment Methods	100 multiple choice questions through computer based online examinations passing minimum is 50%		

Prepared By	**Verified By**	**Approved By**
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Curriculum Development Cell
MCAS (Autonomous) Rasipuram

List of Elective Course(DSE) Details for B.Sc., Microbiology
SYLLABUS - LOCF-CBCS Pattern
EFFECTIVE FROM THE ACADEMIC YEAR 2021-2022 Onwards

S.No.	COURSE_CODE	TITLE OF THE COURSE
1	21M5UMBE01	MEDICAL PARASITOLOGY AND VIROLOGY
2	21M5UMBE02	RECOMBINANT DNA TECHNOLOGY
3	21M6UMBE03	ADVANCES IN BIOTECHNOLOGY
4	21M6UMBE04	PUBLIC HEALTH MICROBIOLOGY

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M5UMBE01	**MEDICAL PARASITOLOGY AND VIROLOGY**	**DSE - I**	**V**	**6**	**4**	**2**	-	5
Objective	To study and understand about the disease caused by parasites and viruses.							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Introduction** – Classification, Laboratory diagnosis of parasitic infections - Direct and concentration methods. Blood smear examination, Serological examination and molecular diagnosis.	K1-K4	10
II	**Protozoan parasites** - *Entamoeba histolytica, Giardia intestinalis, Trichomonas vaginalis. Haemoflagellate - Leishmania donovani.* Malarial parasite – *Plasmodium falciparum.*	K2-K3	12
III	**Helminthes** - *Ancylostoma duodenale, Ascaris lumbricoides, Wuchereria bancrofti, Enterobius vermicularis, T. solium, Fasiola hepatica.*	K1-K3	13
IV	General properties – Structural, Classification, Cultivation, Isolation and identification of viruses - Pox viruses - Variola, Herpes Simplex Virus, Hepatitis virus - A & B.	K1-K3	12
V	Picorna viruses - Polio, Orthomyxovirus - Influenza, Paramyxo virus - Mumps, Measles, Rhabdo virus - Rabies virus, Arbo viruses - JEV, Dengue. Retero virus - HIV. Emerging viral disease – SARS and Covid 19.	K3	13
Course Outcome	**CO1:** Remember and analyze the laboratory diagnosis of various parasites.	K1	
	CO2: Understand the knowledge on the protozoan parasites.	K2	
	CO3: Apply the knowledge on the helminthic parasites.	K3	
	CO4: Apply the knowledge of properties and classification of DNA viruses.	K3	
	CO5: Apply and analyze the knowledge of properties and classification of RNA viruses.	K4	

Learning Resources	
Text Books	1. Medical Parasitology, Rajesh Karyrkarte, Ajit Damla, (2015). 3rd edition. Books and allied publishers Ltd. Kolkata 2. Saravanan P (2006) Virology. First edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
Reference Books	1. Textbook of Medical Parasitology, Subash O. Barija, 2013. Fourth edition. All India Publishers and Distributors Regd. 920 Poonamallee High Road, Chennai. 2. Ananthanarayan R and Jayaram Paniker CK (2020) Text Book of Microbiology. 11th edition, Orient Longman Limited, Hyderabad. 3. Chakraborty P (2013). A Text book of Microbiology. 3rd edition, Published by New Central Agency (P) Ltd., Kolkata

Website Link	1. https://onlinecourses.swayam2.ac.in/cec20_bt15/preview 2. https://www.classcentral.com/course/swayam-virology-20019 3. https://www.digimat.in/nptel/courses/medical/microbiology/MB76.html			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	Course Title				Course Type	Sem.	Hours	L	T	P	C
21M5UMBE01	MEDICAL PARASITOLOGY AND VIROLOGY				DSE - I	V	6	4	2	-	5
CO-PO Mapping											
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	S	S	S	S	M	S	S	S	S	S	
CO2	S	S	S	S	M	S	S	S	S	S	
CO3	S	S	S	S	S	S	S	S	S	S	
CO4	S	S	S	S	S	S	S	S	S	S	
CO5	S	S	S	S	S	S	S	S	S	S	
Level of Correlation between CO and PO	L-LOW				M-MEDIUM			S-STRONG			

Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app,	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE	
Designed By	Verified By	Approved By
Dr.S.Anbalagan	Dr.M.Selvan	Dr.S.SHAHITHA

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M5UMBE02	**RECOMBINANT DNA TECHNOLOGY**	**DSE - II**	V	6	4	2	-	5
Objective	The course designed by getting more knowledge about gene transformation and production of recombinant products.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Gene Cloning:** History and achievements of rDNA technology, Nomenclature, classification of Restriction Endonucleases – ligases. Gene cloning in prokaryotes - cloning strategies. Construction of genomic library and cDNA library.	K1-K2	12
II	**Cloning Vectors** - Plasmid based vectors - Natural (pSClOl, pMBl), Artificial (pBR322 and pUC10). Phage based vectors - Lambda phage vectors. Hybrid vectors - Phagemid, Phasmid and Cosmid. BAC and YAC.	K2	14
III	**Gene Transfer Techniques** - Physical - Biolistic method, Chemical - Calcium chloride and DEAE methods, Biological method - Ti Plasmid. Screening and selection of recombinants.	K2-K3	12
IV	**Commercial Products of rDNA** - Insulin, Interferons, Human Growth Hormone – Somatotropin, Antibiotics - Streptomycin, Biopolymers – polyhydroxy alkanotes.	K2	10
V	**Transgenesis** - Ti plasmid, Insect resistant plant. Transgenic animal - mice - Retroviral method - DNA microinjection method. PCR methods and its applications.	K2-K3	12
Course Outcome	**CO1:** Remember about the basic tools of rDNA technology.	K1	
	CO2: Understand the knowledge of vectors used in rDNA technology	K2	
	CO3: Apply the knowledge of gene transfer methods.	K3	
	CO4: Apply the knowledge of pharmaceutical products.	K3	
	CO5: Apply the knowledge of transgenic products.	K3	

Learning Resources	
Text Books	1. Mitra (2017). Genetic engineering. 2nd edition. Published by Macmillan India Ltd., Chennai. 2. S. N. Jogdand (2016). Gene biotechnology. 4th edition. Himalaya Publishing House, Mumbai.
Reference Books	1. Satyanarayana (2005). Biotechnology. First edition, Books and Allied (P) Ltd., Kolkata. 2. Preeti Joshi (2002). Genetic engineering and its application. First edition, Agrobios (India). 3. Dubey RC (2014). A Text of Biotechnology. Multicolor Illustrative 5th edition, S.Chand and Company Ltd., New Delhi. 4. Bernad R Glick (2003). Molecular Biotechnology - Principles and Applications of Recombinant DNA. Third edition, ASM Press, Washington, D.C

Website Link	1.https://onlinecourses.nptel.ac.in/noc19_bt15/preview 2.https://www.classcentral.com/course/swayam-genetic-engineering-theory-and-application-14090 3.https://www.coursera.org/lecture/synbioethics/week-1-introduction-RbrgE			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M5UMBE02	RECOMBINANT DNA TECHNOLOGY	DSE - II	V	5	4	2	-	5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S	S	S	S	S	S
CO2	S	M	S	S	M	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app,	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By**
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Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M6UMBE03	**ADVANCES IN BIOTECHNOLOGY**	**DSE - III**	**VI**	5	5	-	-	5
Objective	To understand the various applications in Biotechnology.							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Biotechnological Perspectives:** Scope of Biotechnology, Conventional & Modern Biotechnology, Biotechnology Tree. Prospects of Biotechnology in India, Impact of Biotechnology, New Goals of Biotechnology.	K1-K2	12
II	**Genetic Engineering:** Cloning strategies- Genome Organization. Physical and genetic mapping, gene tagging, gene silencing and DNA sequencing.	K2	11
III	**Tools of gene cloning:** Enzymes - Restriction endonucleases, Ligases; Vectors – Bacterial- PBR322, PUC vectors, *Agrobacterium* vectors, yeast vectors and phage vectors.	K1-K2	12
IV	**Techniques of gene cloning and genome analysis**: Gene transfer methods – vector mediated and direct transfer methods, PCR techniques. RAPD, RFLP. Methods of screening of recombinants.	K1-K3	12
V	**Modern concepts:** Principles of Bioinformatics- Protein engineering – Genome projects – HGP. Structural genomics, Nanobiotechnology – Biological synthesis of nanoparticles. IPR.	K1-K2	13
Course Outcome	**CO1:** Remember about the basic knowledge of Biotechnology.	K1	
	CO2: Understand the knowledge of genetic engineering studies.	K2	
	CO3: Understand the study of tools in gene cloning.	K2	
	CO4: Apply the gene cloning methods.	K3	
	CO5: Construct the knowledge of nanoscience.	K3	

Learning Resources	
Text Books	1. Primrose SB and Twyman RM. (2013). Principles of Gene Manipulation, 7th Edition, Blackwell Scientific Publishers, Oxford. 2. James D Watson. (2001). Recombinant DNA, Scientific American Books. USA 3. Glick B Pasternak JJ. (2007). Molecular Biotechnology, ASM Press, Washington
Reference Books	1. Dubay RC. (2014). A Text book of Biotechnology, 5TH edition. S.Chand & Company, New Delhi. 2. Sathyanarayana U. (2020). Biotechnology, 1st Edition, Books and Allied (P) Ltd, Kolkata. 3. Christof M.Niemayer, Chad A Mirkin. (2004). Nano biotechnology: Concepts, Applications and Perspectives, Wiley VCH publishers. 4. Irfan Ali Khan. (2004). Fundamentals of Biotechnology, Forensic Science and Genetic Engineering, Ukaaz Publications. Hydrabad.

Website Link	1. https://onlinecourses.nptel.ac.in/noc19_bt15/preview 2. https://www.classcentral.com/course/swayam-genetic-engineering-theory-and-application-14090 3. https://www.coursera.org/lecture/synbioethics/week-1-introduction-RbrgE			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M6UMBE03	ADVANCES IN BIOTECHNOLOGY	DSE - III	VI	5	5	-	-	5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	M	S	M	S
CO2	S	S	S	S	M	S	S	S	M	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app,
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved By
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Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M6UMBE04	**PUBLIC HEALTH MICROBIOLOGY**	**DSE - IV**	**VI**	5	5	-	-	5
Objective	To understand the various microbial diseases in epidemiological survey, treatment and control measures.							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Air Borne Diseases**: Definition – scope - concept and importance. Microbial air pollution: Microorganisms as biological indicators of air pollution - WHO guideline (microbial pollution). Air borne diseases, Characters of organisms and controls of Pneumonia, Diphtheria, Tuberculosis, Influenza and Measles.	K1-K2	12
II	**Water And Food Borne Diseases:** Microorganisms in water: Transmission of pathogens. Water borne diseases and control measures: Hepatitis A – Cholera – Typhoid – Amoebiasis – Giardiasis - Poliomyelitis. Food borne diseases: Types of food borne diseases.	K2-K3	12
III	**Endemic, Epidemic and Pandemic Diseases:** Definition-Types, Causes, transmission, control and preventive measures of Chicken pox, Malaria and Dengue, Cholera, Typhoid. Influenza and Covid-19.	K1-K2	12
IV	**Therapeutics**: Antibiotics: Beta lactam antibiotics (Penicillin, Cephalosporins), Quinolones - importance of completing antibiotic regimen - Concept of DOTS- emergence of antibiotic resistance- current issues of MDR/XDR microbial strains. Antiviral agents: Amantadine-acyclovir- azidothymidine - treatment using concept of HAART. Antifungal agents.	K1-K2	12
V	**Prevention Methods**: Prevention of Microbial Diseases: General preventive measures - importance of personal hygiene - environmental sanitation. Vaccines: Importance- types vaccines available against microbial diseases - vaccines for pediatric, adolescent and adults - tropical diseases and traveler's vaccines - new vaccine schedules (compulsory and preventive) in the Indian context.	K1-K2	13
Course Outcome	**CO1:** Remember about the various air borne diseases and its control measures.	K1	
	CO2: Understand about the various water borne disease and their control measures.	K2	
	CO3: Understand the epidemiological survey of microbial diseases.	K2	
	CO4: Choose the therapeutic agents to treat the microbial diseases.	K3	
	CO5: Illustrate the various preventive measures of microbial diseases.	K3	

Learning Resources	
Text Books	1. Carroll, K.C., Pfaller, M.A., Landry, M.L., McAdam, A.J., Patel, R., Sandra S. Richter,S.S. and Warnock, D.W. "Manual of Clinical Microbiology", 2 Volume Set, Twelfth Edition, Wiley publishers, New Jersey, 2019. 2. Gillespie, S.H. and Bamford., K.B., "Medical Microbiology and Infection at a Glance", Fourth Edition, John Wiley & Sons, Chinchester, 2012.

Reference Books	1. Greenwood. D. Medical Microbiology (2012). A Guide to Microbial Infections Pathogenesis, Immunity Laboratory Diagnosis and Control", Eighteenth Edition, Elsevier Science, London. 2. Gualerzi, C.O., Brandi, L., Fabbretti, A. and Pon, C.L., "Antibiotics-Targets, Mechanism and Resistance, Wiley publisher, Germany, 2014. 3. Jawetz, E.J.M. and Adelberg., E.A., "Review of Medical Microbiology", Twenty Sixth Edition, Lang Medical Publications, New York, 2013. 4. Michael R. Barer, R.M and Irving, W.L, "Medical Microbiology-A Guide to Microbial infections" Nineteenth Edition, Elsevier, China, 2018
Website Link	1. http:// www.microbiologyonline.org.uk/sgmprac.htm 2. http:// www.cvm.uiuc.edu/vdl/AppenA_man.html 3. http:// www.microbes.info/resources/education_and learning

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M6UMBE04	PUBLIC HEALTH MICROBIOLOGY	DSE - IV	VI	5	5	-	-	5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app,
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved By
Dr.S.Anbalagan	Dr.M.Selvan	Dr. S. SHALITHA

Curriculum Development Cell
MCAS
(Autonomous)
Rasipuram

List of Skill Based Elective Course (SEC) for B.Sc.,Microbiology
SYLLABUS - LOCF-CBCS Pattern
EFFECTIVE FROM THE ACADEMIC YEAR 2021-2022 Onwards

S.No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	III	21M3UMBS01	BIOINSTRUMENTATION
2	IV	21M4UMBS02	MUSHROOM TECHNOLOGY
3	V	21M5UMBS03	MEDICAL LAB TECHNOLOGY
4	VI	21M6UMBS04	ENTREPRENEURSHIP IN MICROBIOLOGY
5		21MXUMBS05	ABILITY AND SKILL ENHANCEMENT
6		21MXUMBS06	BIOFERTILIZER AND ORGANIC FARMING TECHNOLOGY

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3UMBS01	BIOINSTRUMENTATION	SEC - I	III	3	L			2
Objective	To gather the general knowledge about technical orientation based on these instruments							

Unit	Course Content	Knowledge Levels	Sessions
I	**Definition and calculations of molar & Normality:** Preparation of Buffers- Phosphate, TE, TAE. Instrumentations - pH meter, Water Bath, water bath shaker, Autoclave, Hot air oven, Laminar air flow, Incubator and BOD incubator.	K1-K3	6
II	**Colorimetry & Spectrometery**: Turbidometry, Spectrometery –single and double beam, UV and Visible spectrophotometer, Flame photometry.	K1-K3	6
III	**Centrifugation:** Basic principles of Sedimentation – types of rotors - types of centrifuges – small bench, micro centrifuge, large capacity refrigerated, high speed and ultra centrifuge. Differential centrifugation – density gradient centrifugation.	K3	6
IV	**Chromatography:** Paper – ascending and descending. Thin layer, Column, Ion-exchange, Gas, Gel filtration and HPLC. Applications of chromatography.	K2	6
V	**Electrophoresis & Blotting Techniques:** Agarose gel electrophoresis, Native page, SDS – PAGE and submarine gel electrophoresis. Blotting Techniques – Southern, northern, western, DOT blot.	K2-K3	6
Course Outcome	**CO1:** Remember the knowledge about buffers and basic instrument operations.	K1	
	CO2: Demonstrate the knowledge about the specific instruments and its mechanisms.	K3	
	CO3: Apply the knowledge about the molecules separation techniques.	K3	
	CO4: Interpret about the molecules purification methods.	K3	
	CO5: Apply the knowledge about biomolecules separations techniques based on electric charge.	K3	

Learning Resources

Text Books	1. Gedder, A. and L. E. Balser, John Wiley and Sons, Principles of applied Biomedical instrumentation. 2. Boyer, Rodney, F. Benjamin and Cummins, Modern Experimental Biochemistry 2nd Edition. 3. E.Padmini., Biochemical Calculations and Biostatistics (2007) Books and Allied (P) Ltd., First Edtn.

Reference Books	1. Palanivelu P (2004). Analytical Biochemistry and Separation techniques. Third edition, MKU Co-op, Press Ltd., Palkalai Nagar, Madurai. 2. Gurumani N (2006). Research Methodology for Biological Sciences. First edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai. 3. Upadhyay & Upadhyay. Biophysical Chemistry, (2010). Himalaya Publishing house.
Website Link	1. https://chromatography.conferenceseries.com/events-list/applications-of-chromatography 2. http://www.biologydiscussion.com/biochemistry/centrifugation/centrifuge-introduction-types-uses-and-other-details-with-diagram/12489 3. https://www.goodreads.com/book/show/52842183-biophysics

	L-Lecture	T-Tutorial	P-Practical		C-Credit			

B.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards									
Course Code	**Course Title**			**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M3UMBS01	**BIOINSTRUMENTATION**			**SEC - I**	**III**	**3**	**3**			**2**

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, PPT, Video presentation
Assesment Methods	Unit Test, Class Test, Assignment, Internal Examination, Model Presentation

Designed By	**Verified By**	**Approved By**
Mrs.N.Sathyabama	Dr.M.Selvan	

MUTHAYAMMAL COLLEGE OF ARTS & SCIENCE * RASIPURAM 637 408 Tamil Nadu

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M4UMBS02	**MUSHROOM TECHNOLOGY**	**SEC - II**	**IV**	**2**	**2**	**-**	**-**	**2**
Objective	To facilitate self-employment							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Introduction to mushroom cultivation**: Introduction – History of mushroom cultivation, Classification and distribution of mushroom - Identification of poisonous mushrooms -life cycle of mushroom.	K1-K2	4
II	**Spawn preparation:** Spawn preparation - Nutrient media for pure culture, Isolation of pure culture, layout of spawn preparation room, raw material of spawn, sterilization, preparation of mother spawn and multiplication.	K3	4
III	**Cultivation of mushroom:** layout of mushroom shed - small scale and large scale production unit. Types of raw material – preparation and sterilization, Mushroom bed preparation – maintenance of mushroom shed, harvesting method and preservation of mushrooms. **Cultivation of different mushroom:** Cultivation of following types of mushroom – milky mushroom, oyster mushroom, button mushroom and any one medically valuable mushroom.	K2-K3	4
IV	**Nutritive value of mushroom:** Nutrient values of mushroom – protein, carbohydrate, fat, fibre, vitamins and amino acids contents, short and long term storage value addition of mushroom, preparation of various dishes from mushroom.	K2	4
V	**Medicinal value of mushroom:** cultivation, extraction, isolation and identification of active principle from mushroom. Pharmacological and economic values of mushroom.	K2	4
Course Outcome	**CO1:** Remember the morphology and types of Mushrooms.	K1	
	CO2: Remember the knowledge about spawn production on their own.	K1	
	CO3: Understand the nutritive value of mushrooms.	K2	
	CO4: Calculate the medicinal value of mushrooms	K3	
	CO5 : Construct the mushroom cultivation techniques in small scale industry	K3	

Learning Resources	
Text Books	1. Tewan and Pankaj Kapoor S.C. 1993. Mushroom cultivation. Mittal Publication. Delhi. 2. Marimuth et al., 1991. Oyster Mushrooms. Dept. of Plant pathology, TNAU, Coimbatore. 3. Nita Bahl. 1988. Hand book of Mushrooms, 2nd Edition, Vol I & II.
Reference Books	1. Paul Stamets, J.S. and Chilton, J.S. 2004. Mushroom cultivation A practical guide to growing mushrooms at home, Agarikon Press. 2. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms Cultivation, nutritional value,

	medicinal effect and environmental impact. 2nd ed., CRC press.
Website Link	1. https://www.pdfdrive.com/mushroom-cultivator-a-practical-guide-to-growing-mushrooms-at-home-e158710567.html 2. fungi.com/products/the-mushroom-cultivator 3.https://www.google.co.in/books/edition/Psilocybin_Mushroom_Handbook/HJJmJYCl3HsC?hl=en&gbpv=0

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M4UMBS02	MUSHROOM TECHNOLOGY	SEC - II	IV	2	2	-	-	2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	M	L	M	L	S	M	M	M	L
CO5	S	L	L	M	L	S	L	M	M	L

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved By
Mr.N.Radhakrishnan	Dr.M.Selvan	

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M5UMBS03	**MEDICAL LAB TECHNOLOGY**	**SEC- III**	V	3	3	-	-	2
Objective	To apply the knowledge about the various methods in clinical laboratory.							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Collection and Processing of Clinical Specimens** - SOP - Methods of Collection, transport and processing of Clinical specimens - Blood, Urine, Sputum, CSF, Pus & Faeces for microbiological examination. Bio safety measures, Hospital waste management and disposal.	K1-K3	6
II	**Bio Chemistry**: Analysis of blood and urine – glucose, urea, creatinine, total cholesterol. Analysis of CSF, liver function test, thyroid function test.	K2-K3	6
III	**Blood Banking and Immunology**: Introduction – separation of serum, compatibility test, investigation of transfusion reaction. Quality assurance and blood bank. Serological test – WIDAL test, RPR, RA, βHCG, ELISA – HIV, HBs Ag and dengue test.	K1-K3	6
IV	**Microbiology:** General procedures for isolation and identification of bacteria by staining methods and bio chemical reaction (IMViC, TSI, Catalase, Oxidase & Urease). Identification of protozoan parasites. Identification of fungus by wet mount - LCB method - Serological test for fungus. Preparation of Indian ink.	K1-K4	6
V	**Clinical Pathology**: Blood smear examination, Staining of blood films, Total and differential count of RBC, WBC, and Platelets. ESR, PCV, Bleeding time, Clotting time, Prothrombin time.	K1-K3	6
Course Outcome	**CO1:** Remember about the clinical sample collection and processing.	K1	
	CO2: Understand the knowledge about the clinical sample analysis.	K2	
	CO3: Apply the knowledge about the serology & immunological Methods.	K3	
	CO4: Analyze the microorganisms using various biochemical Methods.	K4	
	CO5: Apply the knowledge of pathological studies.	K3	

Learning Resources	
Text Books	1. Bailey &Scott's (2014). Diagnostic Microbiology. 13th edition, The C.V. Mosby Company. 2. Abdul Khader. (2003). Medical Laboratory Techniques. First edition, Frontline Publications, Hyderabad

Reference Books	1. Mukherjee, L. (2017). Medical Laboratory Technology. Volume I & II. Tata McGrew- Hill Publishing Company Limited, New Delhi. 2. Sundararaj, T (2005). Microbiology Laboratory Manual, Perungudi, Chennai-96. 3. Godkar, P.B. (2021). Textbook of Medical Laboratory Technology, 3rd Edition, Bhalani Publication. 4. Seiverd, Charles, E. Hematology for Medical Technologies, 4th Edition, Lea &Febiger, US.
Website Link	1.https://www.pdfdrive.com › wintrobes-clinical-hematology 2.https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5 3.https://vlab.amrita.edu/index.php?sub=3&brch=272

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	**Course Title**		**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
21M5UMBS03	**MEDICAL LAB TECHNOLOGY**		**SEC- III**	V	3	3	-	-	2	
CO-PO Mapping										
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW			M-MEDIUM			S-STRONG			

Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app,	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By**
Dr.M.Selvan	Dr.M.Selvan	Dr.S.SHANTHA

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M6UMBS04	**ENTREPRENEURSHIP IN MICROBIOLOGY**	**SEC- IV**	**VI**	4	4	-	-	2
Objective	To understand the various kinetics of business scheme in Microbiology field.							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Introduction to Entrepreneur:** Evolution of the concept of entrepreneur – Entrepreneurship; Definitions- concept of Entrepreneurship, development- need- role of resource, talent and spirits – process of Entrepreneurship to socio- economic gains	K1-K2	7
II	**Entrepreneur skills:** Skills of entrepreneurs- communication skills , problem solving skills; business planning development; market need- market research , SWOT- analysis, identifying competitors. Financial plan- financial support for business, business insurance, Marketing.	K2-K2	8
III	**Schemes for Entrepreneur:** Institution and schemes of government of India- scheme and programmes, department of science and technology schemes, nationalized banks – other financial institution- SIDBI- NSIC- NABARD- IDBI- IFCI and ICICI.	K1-K2	8
IV	**Microbial products**: Bread baking - baking process, fermented products, mushroom cultivation. Preparation of compost, filling tray beds – spawing, maintaining optimum temperature, casing, watering, harvesting, storage. Biofertilizer – historical background, chemical fertilizer versus biofertilizer, *Rhizobium sp*, *Azospirullum sp, Azotobacter sp*. Organic farming.	K1-K4	9
V	**Patenting and IPR:** Patent and secret process, history of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent, patents in India and other countries.	K1-K2	7
Course Outcome	**CO1:** Remember about the ideas about the entrepreneur aspect.	K1	
	CO2: Outline about the various skills and marketing.	K2	
	CO3: Classify the various schemes for entrepreneurship.	K2	
	CO4: Assume the production of various microbial products.	K4	
	CO5: Contrast the patenting process..	K2	

Learning Resources	
Text Books	1. Mohanty, S.K., Fundamentals of Entrepreneurship, Sixth Edition, Prentice Hall India Private Limited, New Delhi, 2005. 2.Saxena, S., Applied Microbiology, Springer, New York, 2015

Reference Books	1. Bhatia, B.S. and Batra, G.S., - Entrepreneurship and small business management, Deep & Deep Publications, New Delhi, 2003. 2. Hisrich, D.R., Entrepreneurship, 6th Edition, Tata McGraw Hill Private Limited, New Delhi, 2008. 3. Khanka, S.S., Entrepreneurial Development, 4th Edition, S. Chand & Company Limited, New Delhi, 2019. 4. Nagendra, S., Entrepreneurship and Management, Sanguine technical Publishers, New Delhi, 2008.
Website Link	1. http://www.simbhq.org/ 2 https://www.rapidmicrobiology.com/ 3 http://rapidmicromethods.com/ 4 swayam.gov.in › nd1_noc20_bt21

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M6UMBS04	ENTREPRENEURSHIP IN MICROBIOLOGY	SEC- IV	VI	4	4	-	-	2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app,
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved By
Mr.N.Radhakrishnan	Dr.M.Selvan	Dr.S.SHAHITHA

Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	ABILITY AND SKILL ENHANCEMENT	**SEC - IV**		**2**	**2**	**-**	**-**	**2**
Objective	This paper intends to build up the four primary skills in students in the academic and public offices							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Leadership:** What is leadership, traits of leadership, identifying leaders and traits of leadership, Identify leadership qualities.	K1-K2	4
II	**Entrepreneurship:** What is Entrepreneurship, traits of successful entrepreneurs, Identify entrepreneurial qualities.	K1-K2	3
III	**Organizational Skills & Employability Skills:** What are organizational skills, skills needed to become a successful entrepreneur/administrator. Organizational skills development - discipline making, rules, delegation of power at workplace, etc. How to enhance employability; skills, why do we need them, different workplaces, different skills, how to recognize different work skills.	K1-K2	5
IV	**Decision making:** Process of decision making, its steps, basics of organizational decision -making process, entrepreneurial decision making, how to make a right decision at right time, dilemma.	K1-K2	4
V	**Interview Skills:** Conducting Interviews with Leaders/ Entrepreneurs, Preparing Questions, Interviewing the fellow person, do's & don'ts while taking interview.	K1-K3	4
Course Outcome	**CO1:** Describe about the leadership and its traits.	K1	
	CO2: Understand and apply the concept of entrepreneurship.	K2	
	CO3: Summarize about the employability and organizational skills.	K2	
	CO4: Discuss the knowledge about decision making.	K2	
	CO5: Emphasize and apply the knowledge of interview skills.	K3	

Learning Resources	
Text Books	1. Organisational Behaviour , M.Parikh and R.Gupta , TataMcGraw Hill Education Private Limited 2. Organisational Behavior, D. Nelson, J.C Quick and P. Khandelwal, Cengage Publication.
Reference Books	1. Understanding Leadership. Avery, G. C. (2005). London: Sage Publications 2. Leadership and performance beyond expectations. Bass, B.M. (1985). New York: Free Press.
Website Link	1. https://www.skillsyouneed.com/general/life-skills.html 2. https://blog.clrskills.com/the-concept-of-skills-development/ 3. https://www.cbse.gov.in/cbsenew/list-of-manuals/life_skills_cce.pdf

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	Course Title				Course Type		Sem.	Hours	L	T	P	C
	ABILITY AND SKILL ENHANCEMENT				SEC - IV			2	2	-	-	2
CO-PO Mapping												
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	S	S	S	S	S	M	S	L	M	M		
CO2	S	S	S	S	S	M	S	L	M	M		
CO3	S	S	S	S	S	M	S	L	M	M		
CO4	S	S	S	S	S	M	S	L	M	M		
CO5	S	S	S	S	S	M	S	L	M	M		
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG			
Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app											
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation											
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE											
Designed By					Verified By				Approved By			
Mr.N.Radhakrishnan					Dr.M.Selvan				Dr.S.SHAHITHA			

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	BIOFERTILIZER AND ORGANIC FARMING TECHNOLOGY	**SEC - VI**		**2**	**2**	**-**	**-**	**2**
Objective	To impart the knowledge of herbal medicine, cultivation and marketing strategies							
Unit	**Course Content**					**Knowledge Levels**		**Sessions**
I	**Basics of Biofertilizers:** Biofertilizers – definition, importance and advantages. Sources of Biofertilizers - Bacteria, Cyanobacteria, Mycorrhiza and PSM. Outlines of production technology of biofertilizers- isolation, selection of strain, preparation of mother culture, starter culture, mass culturing.					K1-K3		4
II	**Culture of Bacterial and fungal Biofertilizers**: *Rhizobium, Azatobacter, Azospirillum* - Mass multiplication, inoculam formulations, associative effect and crop response. Anabaena- Characteristics, Azolla-Anabaena association, Azolla production and application. VAM- mass production.					K1-K3		4
III	**Biofertilizer Production Technology:** Culturing of microorganisms. Inoculam formulations – Carrier properties, Types of formulations: Powders, Granules and Liquids.					K1-K3		4
IV	**Concept of organic farming:** Introduction of organic farming. Principles of organic farming. Types of organic farming and benefits of organic farming. Scope of organic farming. Conventional farming v/s organic farming. Requirements of organic farming.					K1-K3		4
V	**Organic plant nutrient management:** Organic farming systems- soil tillage, land preparation and mulching. Propagation of seeds, planting material and seed treatment.					K1-K3		4
Course Outcome	**CO1:** Remember about the production of biofertilizers.					K1		
	CO2: Understand the production methods in bacteria, fungal and algal biofertilizers.					K2		
	CO3: Apply the production technology of inoculants.					K2		
	CO4: Choose the knowledge about organic farming.					K2		
	CO5: Experiment the knowledge about plant nutrients management.					K3		
Learning Resources								
Text Books	1. Dahama, A. K. 2005. Organic Farming for sustainable agriculture. Agrobios (India) Jodhpur. 2. Gahlot, D. 2005. Organic Farming. Agrobios (India) Jodhpur. 3. Palaniappan, S. P. and Anandurai, K. 1999. Organic Farming. Theory and Practices. Scientific Publication Jodhpur.							

Reference Books	1. Principles of Organic Farming By E. Somasundaram, D. Udhaya Nandhini, M. Meyyappan 2. Whole Farm Planning: Ecological Imperatives, Personal Values and Economics by Elizabeth Henderson and Karl North 3. Basics Of Organic Farming by English, Paperback, Bansal M.			
Website Link	1. https://agritech.tnau.ac.in/org_farm/orgfarm_index.html 2. https://vikaspedia.in/agriculture/crop-production/organic-farming 3. http://omafra.gov.on.ca/english/crops/facts/09-077.htm			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	**Course Title**			**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	BIOFERTILIZER AND ORGANIC FARMING TECHNOLOGY			**SEC - VI**			**2**	**2**	**-**	**-**	**2**
CO-PO Mapping										
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	
Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation									
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE									
Designed By				**Verified By**				**Approved By**		
Mrs.N.Sathyabama				Dr.M.Selvan						

Dr. S. SHANTHA

Curriculum Development Cell MCAS Autonomous Rasipuram

List of Non Major Elective Course (NMEC) offered by the B.Sc., Microbiology
SYLLABUS - LOCF-CBCS Pattern
EFFECTIVE FROM THE ACADEMIC YEAR 2021-2022 Onwards

S.No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1		21MXUMBN01	INFECTIOUS DISEASES
2		21MXUMBN02	HEALTH AND HUMAN DISEASES
3		21MXUMBN03	FOOD TECHNOLOGY
4		21MXUMBN04	HERBAL MEDICINE

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	INFECTIOUS DISEASES	**NMEC-**		**2**	**2**	**-**	**-**	**2**
Objective	To understand the medically important bacteria, fungi, virus and parasites							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	Distribution of pathogenic microorganisms and ubiquitous nature of pathogens, history of infectious and their invasiveness. Host parasite Interactions.	K1-K2	4
II	Laboratory identification, epidemiology and control measures of Salmonellosis, Botulisom, Mycobacterium, Corynebacterium, leptospirosis and Streptococcal infections	K1-K2	4
III	Nosocomial infections, History of viral diseases, Smallpox, AIDS, Recent epidemics- Covid-19, Nipha, Monkey pox. Antiviral drugs and prevention.	K1-K2	4
IV	Pathogenesis, occurrence, epidemiology and treatment of Histoplasmosis, Aspergillosis and Candidiasis.	K1-K3	4
V	Pathogenesis, distribution and diagnostic measures of Malaria, Amoebiasis and Ascariasis.	K1-K3	4
Course Outcome	**CO1:** Remember the knowledge about history of infectious agents.	K1	
	CO2: Remember and understand the knowledge about medically important bacterial agents.	K2	
	CO3: Understand the Pathogenesis of medically important virus.	K2	
	CO4: Illustrate the knowledge about medically important fungi.	K3	
	CO5: Apply the knowledge about medically important parasites.	K3	

Learning Resources

Text Books	1. Sheehan, C. (1997) Clinical Immunology. Principles and Laboratory diagnosis, second Edn. Lipincott Williams and Wilkins, New York. 2. Dubey RC and Maheswari DK (2012). A text of Microbiology (Revised edition). S. Chand and Company Ltd., New Delhi 3. Geeta Sumbali and Mehrotra RS (2009).Principles of Microbiology. First edition, Tata McGraw Hill P. Ltd., New Delhi.
Reference Books	1. Boyd, RF. And Hoer, BG. (1991) Basic Medical Microbiology. 4th Edn. Little Brown and Co. New York. 2. Prescott L M, J P Harley and D A Klein (2005). Microbiology. Sixth edition, International edition, McGraw Hill. 3. Hans G. Schlegel. General microbiology. 7th edition. Cambridge university press (1993).

Website Link	1. https://www.amazon.in/Medical-Microbiology-Samuel-Baron/dp/0963117211 2. https://www.ncbi.nlm.nih.gov/books/NBK7627/ 3. https://www.elsevier.com/books/textbook-of-diagnostic-microbiology/mahon/978-0-323-48218-9			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	Course Title			Course Type		Sem.	Hours	L	T	P	C
	INFECTIOUS DISEASES			NMEC-			2	2	-	-	2
CO-PO Mapping											
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	S	S	M	S	S	S	M	S	M	M	
CO2	S	S	S	S	S	S	M	S	M	M	
CO3	S	S	M	S	M	S	M	S	S	S	
CO4	S	S	M	S	M	S	M	S	S	S	
CO5	S	S	M	S	M	S	M	S	S	S	
Level of Correlation between CO and PO	L-LOW				M-MEDIUM			S-STRONG			
Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app										
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation										
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE										
Designed By				Verified By			Approved By				
Dr.M.Selvan				Dr.M.Selvan			Dr.S.SHAHEETHA				

Curriculum Development Cell
MCAS
(Autonomous)
Pasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	HEALTH AND HUMAN DISEASES	**NMEC - II**		**2**	**2**	**-**	**-**	**2**
Objective	To determine the common diseases with their clinical symptoms, mode of transmission, diagnosis and its control measures							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	Introduction - importance of being healthy- nutrition- exercise- causes of disease- environment – age – living conditions – Life style – Role of gut flora in human health, Probiotics & Prebiotics.	K1-K2	4
II	Diseases – causes – symptoms- treatment of – heart diseases- obesity- BMI, jaundice- cancer	K1-K2	4
III	AIDS- Nosocomial diseases- travelling disease- children and old age diseases – TB- leprosy, Dengue- Bird Flu.	K1-K2	4
IV	Diseases prevention – healthy habits, disease prevention awareness- vaccination- immunization schedule	K1-K2	4
V	First aid measures- accident Care- Bleeding and Wound Care – Fractures and dislocations, electric shock burns – breathing emergency – Allergies- Pregnancy care.	K1-K3	4
Course Outcome	**CO1:** Memorize about importance of health and healthy life style.	K1	
	CO2: Understand the common diseases and their treatment.	K2	
	CO3: Explain about the diseases in child and old age groups.	K2	
	CO4: Discuss the knowledge about healthy habits and diseases prevention methods	K2	
	CO5: Illustrate the knowledge about First aid measures	K3	

Learning Resources	
Text Books	1. Ananthanarayan R. and Paniker C.K.J. (2017) Textbook of Microbiology. 10th edition, Kanungo, Reba (Ed).Orient Blackswan Publication. 2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2016) Jawetz, Melnick and Adelberg's Medical Microbiology. 27th edition. McGraw Hill Publication.
Reference Books	1. Willey JM, Sherwood LM, and Woolverton CJ. (2017) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education. 2. Madigan, Bender, Buckley, Sattley and Stahl. (2018). Brock Biology of Microorganisms. 15th edition. Pearson Global Edition. 3. Tortora GJ, Funke BR, and Case CL. (2016). Microbiology: An Introduction. 11thedition Pearson Education India.

Website Link	1. https://mechpath.com/2015/12/01/mycobacterium-leprae/ 2. https://www.slideshare.net/El_Omda/anthrax-15737452 3. https://www.elsevier.com/books/textbook-of-diagnostic-microbiology/mahon/978-0-323-48218-9			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	HEALTH AND HUMAN DISEASES		**NMEC - II**			**2**	**2**	-	-	**2**
CO-PO Mapping										
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	M	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	M	S	S	S	M	S	M	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	M	S	S	S	M	S
Level of Correlation between CO and PO	L-LOW				M-MEDIUM			S-STRONG		
Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation									
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE									
Designed By	**Verified By**						**Approved By**			
Dr.S.Anbalagan	Dr.M.Selvan						Dr. S. SHANTHA			

Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	FOOD TECHNOLOGY	**NMEC- III**		**2**	**2**	**-**	**-**	**2**
Objective	To understand the medically important bacteria, fungi, virus and parasites							
Unit	**Course Content**						**Knowledge Levels**	**Sessions**
I	Introduction to food technology: Scope and applications. Nutrition – types of Nutrition, Food used in different ages – infants, children, school age, and adult. Factors determine the quality of food – intrinsic and extrinsic factors.						K1-K2	4
II	Microbial fermentation of food: Curd, yogurt and sauerkraut, Bread, Beer, Cheese, Pickle, Kefir, Kimchi, Soy sauce, rice wine, malt whisky- process and uses.						K1-K2	4
III	Common Food borne Bacteria: Molds and yeasts, Role, Significance of Microorganisms in Foods. Food borne pathogens - Campylobacter, Clostridium, Salmonella, *Shigella, Vibrio, Staphylococcus, E.coli,* Amoebiosis and Mycotoxins.						K1-K2	4
IV	Food Preservation & Principles: Physical, Chemicals and Antibiotics-Bacteriocins. Applications of Probiotics and prebiotics.						K1-K3	4
V	Food quality assessment: Standards of food Quality. Pathogens test & Spoilage indicators. Chemical test – pesticides, antibiotics, heavy metals & adulterants. FSSAI, Good Manufacturing Practice (GMP) - Quality Management System & ethics.						K1-K3	4
Course Outcome	CO1: Remember the knowledge about history of infectious agents.						K1	
	CO2: Remember and understand the knowledge about medically important bacterial agents.						K2	
	CO3: Understand the Pathogenesis of medically important virus.						K2	
	CO4: Remember and understand the knowledge about medically important fungi.						K2	
	CO5: Remember and understand the knowledge about medically important parasites.						K2	
Learning Resources								
Text Books	1. Frazier and Westhoff, DC. 1988. Food Microbiology. TATA McGraw Hill Publishing Company LTD., New Delhi 2. Dubey RC and Maheswari DK (2012). A text of Microbiology (Revised edition). S. Chand and Company Ltd., New Delhi							

	3. Geeta Sumbali and Mehrotra RS (2009).Principles of Microbiology. First edition, Tata McGraw Hill P. Ltd., New Delhi.
Reference Books	1. Adams, M.R and Moss, MO. 1995. Food Microbiology. The Royal Society of Chemistry, Cambridge 2. Maheshwary. Nutrition and dietetic. New Delhi 3. KhetarpaulNeelam. Food Processing and Preservation, Daya Publishing House, Delhi. 2005.
Website Link	1. https://www.fda.gov/ 2. https://en.wikipedia.org/wiki/Food_Safety_and_Standards_Authority_of_India 3. https://www.bookdepository.com/Food-Preservation-S-K-Kulshrestha/9780706986600

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
	FOOD TECHNOLOGY	**NMEC- III**		**2**	**2**	**-**	**-**	**2**

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	M	M	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved By
Mr.N.Radhakrishnan	Dr.M.Selvan	Dr.S.SHAHITHA

Curriculum Development Cell MCAS (Autonomous) Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	HERBAL MEDICINE	**NMEC - IV**		**2**	**2**	**-**	**-**	**2**
Objective	To impart the knowledge of herbal medicine, cultivation and marketing strategies							
Unit	**Course Content**						**Knowledge Levels**	**Sessions**
I	**Introduction:** Scope - Alternative systems of medicine – advantages – human system – herbals for human system – definition.						K1	4
II	**Secondary metabolites:** Source- different types – action – medicinal plants – pharmacological action – toxicity. Role of short chain fatty acids and their significant.						K2	4
III	**Herbal cultivation:** Plant – types - Methodology – marketing – economic potential – pharmacological companies – manufacture – patency – GATT-TRIPS- WTO.						K2	4
IV	**Herbal gardening:** Types – methodologies – applications – home gardens – types – methodologies – application – home made remedies – herbal formulations- herbal physiotherapy.						K3	4
V	**Biological screening of herbal drugs:** introduction and need for phyto pharmacological screening. Antimicrobial screening of herbal drugs, Screening for anticancer activity, Screening for antioxidant activity, Database on pharmaceutical uses of plants.						K3	4
Course Outcome	**CO1:** Remember the knowledge about importance of herbal medicine.						K1	
	CO2: Understand the medicinal plans metabolites.						K2	
	CO3: Summarize about the herbal medicine cultivation and marketing.						K2	
	CO4: Apply the knowledge about herbal gardening, formulation and treatment.						K3	
	CO5: Make use of screening of herbal compounds.						K3	
Learning Resources								
Text Books	1. Biotechnology of Secondary metabolites K.G.Ramawat, J. M. Muritton. 2. Indian medicinal plants Vol-I to Vol – V: A compendium of 500 Species – Orient Longman 3. The Modern Herbal by Maude Grieve 1931.							
Reference Books	1. Introduction to spices, plantation crops, Medicinal aromatic plants – N.Kumar *et. al.*, 2. Maheshwary. Nutrition and dietetic. New Delhi 3. The Complete Herbal Tutor: The Ideal Companion for Study and Practice by Anne McIntyre.							

Website Link	1. https://www.elsevier.com/books/herbal-medicines/siddique/978-0-323-90572-5 2. hestnutherbs.com/the-best-herbal-medicine-books-for-beginning-herbalists/ 3. https://www.booktopia.com.au/books-online/non-fiction/mind-body-spirit/complementary-therapies/traditional-medicine-herbal-remedies/cVXHT-p1.html			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
	HERBAL MEDICINE		**NMEC - IV**			**2**	**2**	-	-	**2**
CO-PO Mapping										
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	M	M	M	S	S	S	M	S
CO2	S	S	M	S	M	S	S	S	M	S
CO3	S	S	S	M	S	S	S	S	M	S
CO4	S	S	S	S	S	S	S	S	M	S
CO5	S	M	S	S	S	S	S	S	M	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	
Tutorial Schedule	Group Discussion, Quiz program, model preparation and Kahoot app									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation									
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE									
Designed By			**Verified By**					**Approved By**		
Dr.S.Anbalagan			Dr.M.Selvan					Dr.S.SHANTHA		

Curriculum Development Cell MCAS Autonomous Rasipuram

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
23UMBVAC01	BIOFERTILIZERS AND BIOPESTICIDES PRODUCTION	VALUE ADDED COURSE		30	20	-	10	2

Objective	To learn about the self employability		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Basics of Biofertilizer**: Biofertilizer- Definition, Importance and advantages. Microorganisms used as biofertilizer – Bacterial, fungal and algal biofertilizer	K1-K2	6
II	**Outline of production technology of biofertilizer** – Isolation, preparation of mother culture and mass culturing. Culture of *Azatobacter, Azospirillum, Anabaena* and VAM.	K1-K2	6
III	**Biological control agents and their characteristics.** Concepts and importance of biopesticides. Types of biopesticides - bacterial and fungal; Advantages and disadvantages	K2	6
IV	**Properties of botanical bio pesticide.** Mode of action of biological insecticides and nematicides. Production and processing of biological insecticides.	K4	6
V	**Field Application methods** – Preparation of carrier based inoculums, peat, vermiculate as innoculum carrier, seed treatment, root dressing and soil application techniques. Storage and maintenance of inoculums.	K4	6
Course Outcome	**CO1:** Remember the knowledge about biofertilizers for sustainable agriculture.	K1	
	CO2: Understand the knowledge about Produce bio fertilizers and bio pesticides on large scale	K2	
	CO3: Understand the knowledge about importance of eco-friendly pesticides.	K2	
	CO4: Interpret the knowledge about prepare inoculums for field application.	K4	
	CO5: Study the efficacy of biofertilizers and biopesticides in organic farming	K4	

Learning Resources

Text Books	1. Kannaiyan, S.,2003, Biotechnology of Biofertilizer, CHIPS, Texas. 2. Mahendra K. Rai, 2005. Hand book of Microbial biofertilizer, The Haworth press, Inc. New York. 3. Saleem, F and A.R. Shakoori,2012.Development of Bioinsecticide, Lambert Academic Publishing, Latvia, European Union.

Reference Books	1. Biofertilizers: Commercial Production Technology and Quality Control, 2017 by Dr. P.Hyma. 2. Biofetilizers for Sustainable Agriculture, 2017;by Arun K.Sharma. 3. Advances In Plant Biopesticides 2021, by Dwijendra Singh, SpringerIndia. 4.BiofertilizersTechnology, 2010, by S.Kaniyan, K.Kumar and K. Govindarajan			
Website Link	1. https://www.mitconbiopharma.com/training/bio-tech-training/certificate-course-in-biofertilizers-biopesticides-production/ 2. https://universitykart.com/course/coursedetails/certificate-in-biofertilizer-production-technology. 3. https://ncof.dacnet.nic.in/30dayscertificatecourseonOrganicFarming			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
23UMBVAC01	BIOFERTILIZERS AND BIOPESTICIDES PRODUCTION	VALUE ADDED COURSE		30	20	-	10	2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	M	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	M	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S - STRONG

Tutorial Schedule	Group Discussion, model preparation and anatomy app,
Teaching and Learning Methods	Chalk and Board class, Assignment, Poster Presentation, Video presentation
Assessment Methods	Class Test, Assignment, Quiz program

Designed By	Verified By	Approved By
Dr.S.Sudhakar	Dr.M.Selvan	

Curriculum Development Cell MCAS (Autonomous) Rasipuram