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
ESTD-1994
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DEGREE OF MASTER OF SCIENCE

Learning Outcomes - Based Curriculum Framework
- Choice Based Credit System

Syllabus for M.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: Post Graduates will be able to promote learning environment to meet the industry expectation.

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

PEO3: Post Graduates will be upholding the human values and environmental sustenance for the betterment of the society.

GRADUATE ATTRIBUTES

Graduate Attributes of M.Sc., Microbiology are:

GA 1 Academic Excellence

GA 2 Communication Skills

GA 3 Critical Thinking

GA 4 Problem solving

GA 5 Individual and Team Work

GA 6 Mortal and Ethics

GA 7 Environment and Sustainability

PROGRAMME OUTCOMES (POs)

PO1: Post graduates will attain profound proficiency and expertise.

PO2: Post graduates will be ensured with corporative self directed learning.

PO3: Post graduates will acquire acumen to handle diverse contexts and function in domains of multiplicity.

PO4: Post graduates will exercise intelligence in research Investigations and Introducing innovations.

PO5: Post graduates will learn ethical values and commit to Professional ethics.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

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

PSO1: Acquire specific skills to microbiology and allied fields for converting information to knowledge through hypothesis, design, execution and analysis.

PSO2: In depth understanding of basic and applied aspects of microbiology.

PSO3: Familiarized with latest and advanced tools and techniques of microbiology.

PSO4: Capacity to develop, employ and integrate technical and professional skills as a member of team withholding the essence of social collaboration and integrity.

PSO5: To independently be able to formulate research projects on microbiology and allied interdisciplinary or multidisciplinary fields through literature search, finding research gaps and framing objectives in order to strive for innovation.

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE(Autonomous) - Rasipuram - 637 408

Scheme of Examinations - LOCF-CBCS Pattern

(for the Students Addmited from the Academic Year:2021-2022 Onwards)

Programme : M.Sc.MICROBIOLOGY

S.No.	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX.MARKS		
				Lect.	Lab.		CIA	ESE	TOTAL
			SEMESTER - I						
1	DSC THEORY - I	21M1PMIC01	GENERAL MICROBIOLOGY	5		4	25	75	100
2	DSC THEORY - II	21M1PMIC02	IMMUNOLOGY AND IMMUNO TECHNOLOGY	5		4	25	75	100
3	DSC THEORY - III	21M1PMIC03	CELL AND MOLECULAR BIOLOGY	5		4	25	75	100
4	DSC PRACTICAL - I	21M1PMIP01	PRACTICAL : GENERAL MICROBIOLOGY AND IMMUNOLOGY		6	3	40	60	100
5	DSC PRACTICAL - II	21M1PMIP02	PRACTICAL : CELL AND MOLECULAR BIOLOGY		3	2	40	60	100
6	DSE - I	21M1PMIE01	DSE - I	6		4	25	75	100
			TOTAL	21	9	21	180	420	600
			SEMESTER - II						
1	DSC THEORY- IV	21M2PMIC04	MEDICAL BACTERIOLOGY AND MYCOLOGY	5		5	25	75	100
2	DSC THEORY - V	21M2PMIC05	INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY	5		5	25	75	100
3	DSC THEORY- VI	21M2PMIC06	GENETIC ENGINEERING AND ADVANCES IN BIOTECHNOLOGY	5		5	25	75	100
4	DSC PRACTICAL - III	21M2PMIP03	PRACTICAL : MEDICAL BACTERIOLOGY AND MYCOLOGY		3	2	40	60	100
5	DSC PRACTICAL - IV	21M2PMIP04	PRACTICAL : GENETIC ENGINEERING AND INDUSTRIAL MICROBIOLOGY		6	3	40	60	100
6	GEC - EDC - I	21M2PMIED1	EDC-MEDICAL LABORATORY TECHNOLOGY	4		4	25	75	100
7	HUMAN RIGHTS	21M2PHUR01	HUMAN RIGHTS	1		2	100		
			TOTAL	20	9	26	280	420	600
			SEMESTER - III						
1	DSC THEORY - VII	21M3PMIC07	MEDICAL VIROLOGY AND PARASITOLOGY	5		5	25	75	100
2	DSC THEORY - VIII	21M3PMIC08	FOOD, DAIRY AND ENVIRONMENTAL MICROBIOLOGY	5		5	25	75	100
3	DSC THEORY - IX	21M3PMIC09	SOIL, AGRICULTURAL MICROBIOLOGY AND BIO DEGRADATION	5		5	25	75	100
4	DSC PRACTICAL - V	21M3PMIP05	PRACTICAL : PARASITOLOGY, FOOD, AND ENVIRONMENTAL MICROBIOLOGY		3	2	40	60	100
5	DSC PRACTICAL - VI	21M3PMIP06	PRACTICAL : AGRICULTURAL MICROBIOLOGY		3	2	40	60	100
6	DSE - II	21M3PMIE02	DSE - II	5		5	25	75	100
7	INTERNSHIP	21M3PMIIS1	INTERNSHIP			2	100		
			TOTAL	20	6	26	280	420	600

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

S.No.	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX.MARKS		
				Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - IV									
1	DSC THEORY - X	21M4PMIC10	RESEARCH METHODOLOGY AND BIO STATISTICS	5		5	25	75	100
2	DSC THEORY - XI	21M4PMIC11	PRINCIPLES OF ECOLOGY	5		5	25	75	100
3	ONLINE COMPETITIVE EXAMINATION	21M4PMIOE1	MICROBIOLOGY FOR COMPETITIVE EXAMINATIONS			2	100		
4	PROJECT WORK	21M4PMIPR1	PROJECT WORK		10	5	50	150	200
			TOTAL	10	10	17	200	300	400
			OVER ALL TOTAL	71	34	90	940	1560	2200
	EXTRA CREDIT COURSE	21M4PMBEC1	MOOC Courses offered in SWAYAM / NPTEL	-	-	2		-	-

Dr.S.SUBHAZ,M.Sc.,M.Phil.,Ph.D.,
Assistant Professor and Head
Department of Microbiology
Muthayammal College of Arts and Science
Rasipuram-637 408, Namakkal (Dt.)
Tamilnadu.

PRINCIPAL
MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE
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RASIPURAM - 637 408,
NAMAKKAL DISTRICT

PG – REGULATIONS

1. Internal Examination Marks - Theory

Components	Marks
CIA I&II	10
Attendance	5
Assignment	5
Seminar	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 (for 75Marks) (3hours)		
Section–A		
(10Marks)	**(Objective Type)**	**10x 1=10Marks**
Answer **ALL** Questions **ALL questions carry EQUAL Marks**		
Section–B		
(15Marks)	**(Analytical Type)**	**3 x 5=15 Marks**
Answer any THREE Questions out of FIVE **questions** **ALL questions carry EQUAL Marks**		
SECTION-C		
(50 Marks)	Either or Type.	**5 x 10 = 50 Marks**
Answer ALL the Questions **ALL** Questions Carry **EQUAL** Marks		
Total		**75Marks**

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

2. a) 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. Internship/Industrial Training, Mini and Major Project Work

Internship/ Field Work Industrial Training		**Project Work**		
Components	**Marks**	**Components**		**Marks**
CIA[1]*		***CIA***		
Work Diary	25	a) Attendance Marks	20	
Report	50	b) Review Marks	30	50
Viva–voce Examination	25			
Total	**100**	***ESE***[1]*		
		a) Final Report Marks	120	
		b) Viva–voce Marks	30	150
		Total		**200**

***[1]**Evaluationof report and conduct of viva– voce will be done jointly by Internal and External Examiners

4. Components for Human Rights Course (CIA Only)

a) The Course Human Rights is to be treated as100% C I A course which is offered in II Semester for I year PG students.
b) Total Marks for the Course =100

Components	Marks
Two Tests	75
Assignments	25
Total	**100**

- In case the candidate fails to secure 50 marks, which is the passing minimum, he/she may have to reappear for the same in the subsequent semesters.

5. Guidelines for Competitive Exams- Online Mode- 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 is 50%
- In case, the candidate fails to secure 50% passing minimum, he/she may have to reappear for the same in the subsequent semesters.

M.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M1PMIC01	**GENERAL MICROBIOLOGY**	**DSC THEORY - I**	**I**	**5**	**5**			**4**
Objective	To enable the students to understand the basic knowledge in Microbiology, microbial taxonomy and metabolism							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Introduction** – Development, Scope and Future of Microbiology -Isolation of different types of bacteria – fungi – actinobacteria – cyanobacteria. Preservation methods of microbes for storage and microscopy studies, Microbial type culture collections. Sterilization and disinfection – physical and chemical methods for controlling microorganisms.	K1-K2	12
II	**Microscopy** - Working principle, instrumentation and applications of Bright field microscope, Phase contrast microscope, Dark field microscope, Fluorescent microscope and Electron microscopes (SEM and TEM). Staining Methods – Simple, Gram, Acid-fast, Spore, Granular, Capsular, Flagellar and Fat bodies.	K1-K2	10
III	**Morphological types** - Gram negative and Gram positive, Cyanobacteria, Archeabacteria and Eubacteria. Ultrastructure of prokaryotic and eukaryotic cells. General Characteristics and Classification of Algae (Fritsch Method) . General Characteristics and Classification of Fungi (Alexopolus).. General Characteristics and Classification of Protozoa.	K1-K2	10
IV	**Microbial Taxonomy**-Definition, systematics, Nomenclature rules and identification, Hierarchical organization and the position of microbes in the living world, classification systems – Haeckel's three kingdom concept-Whittaker's five kingdom concept - three domain concept of Carl Woese. Characterization of microorganisms - Physiological, Metabolic, Serological and Molecular methods- Bergey's Manual of Systematic Bacteriology with general characteristics of each division- Numerical Taxonomy- 16S rRNA based classification. Archeabacterium, Actinomycetes - Structure and Classification.	K1-K2	18
V	**Bacterial Metabolism** -Microbial respiration and fermentative pathway - respiratory metabolism - Embden Mayer Hoff pathway - ED pathway - Glyoxalate pathway – Kreb's cycle - ETC - oxidative and substrate level phosphorylation - TCA cycle – gluconeogenesis - Fermentation of carbohydrates - homo and hetero lactic fermentation. Bioenergetics, Cell division - endospore - structure and properties.	K1-K2	10

Course Outcome	**CO1:** Remember the basic knowledge about microbiology and importance of microorganisms.	K1	
	CO2: Understand about the application of microscopes in staining methods.	K2	
	CO3: Understand the microbial classifications based on morphology.	K2	
	CO4: Understand about the microbial classifications based on physico - chemical characters.	K2	
	CO5: Understand the various bacterial metabolism in fermentation.	K2	

Learning Resources				
Text Books	1. Prescott LM, Harley JP and Klein DA. Microbiology. 7th edition, McGraw Hill, Newyork. 2008 2. Tortora, G.J., Funke, B.R. and Case, C.L. (2016) Microbiology: An Introduction, 11th Edition, Pearson Education, India 3. Dubey, R.C. and Maheshwari, D.K. (2013) A Textbook of Microbiology. Revised Edition, Chand and company, NewDelhi			
Reference Books	1. Holt JS, Kreig NR, Sneath PHA and Williams ST. Bergey"s Manual of Determinative Bacteriology (9th Edition), Williams and Wilkins, 23, Baltimore.1994. 2. Baveja, C.P. and Baveja, V. (2017) APC Text Book of Microbiology.4thEdition, Arya Publications, New Delhi 3. Pelczar TR, Chan ECS and Kreig NR .Microbiology. 5th Edition, Tata McGraw – Hill, New Delhi.2006. 4. Alcamo E. Fundamentals of Microbiology. 6th Ed., Jones and Bartlett Publishers, New Delhi. 2001.			
Website Link	1. https://microbiologyinfo.com/top-and-best-microbiology-books/ 2. www.microbiologyonline.org.uk 3. www.life.umd.edu/classroom/bsci424/BSCI223WebSiteFiles/LectureList.htm 4. https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=404			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

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

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PMIC01	GENERAL MICROBIOLOGY	DSC THEORY - I	I	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	S	S
CO2	S	M	S	S	S	S	S	S	S	S
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	M	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, Video presentation
Assessment Methods	Unit Test, Class Test, Assignment, Internal Examination, Model Presentation

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

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

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PMIC02	IMMUNOLOGY AND IMMUNOTECHNOLOGY	DSC THEORY - II	I	5	5			4

Objective	To enable the students to understand the basic knowledge in Immunology and immune systems		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**The Cells of Immune System:** The Cells of Immune System - An over view of the immunology - Classification of the immune response. Cells and tissues of the immune system. Haematopoiesis: Origin and differentiation of Lymphocytes and phagocytic cells. Primary and secondary lymphoidorgans. Immunogens and antigens-haptens, adjuvants.	K1-K2	12
II	**Humoral Immunity:** Development, maturation, activation and differentiation of B-lymphocytes; Antibody: structure, classes and sub classes; antibody diversity -Antigen and antibody interaction. Complement – Classical, alternate and lectin pathways; Hybridoma technology for production of the monoclonal antibody and applications.	K1-K2	11
III	**Cellular Immunity:** Classification and stages of development (T) Lymphocytes - T cell receptor - Major histocompatibility complex –structure, classification and genetic organization of MHC; mechanism of phagocytosis - ADCC- cell biology of antigen processing and presentation- cytokines; immunosuppression, tolerance.	K1-K2	12
IV	**Hypersensitivity, Transplantation, Immunology of Tumors**: Injury and inflammation; allergy and hypersensitivity – types, Transplantation: types, immunological mechanisms of graft rejection- immunological strategies to prevent graft rejection - Tumors: Immune response to tumors - type of tumor antigens.	K1-K2	11
V	**Auto immunity Immuno pathology and Techniques in Immuno technology Autoimmunity:** Diseases & mechanisms - Preparation and storage of tissues - identification of various cell types and antigens in tissues. Immuno cytochemistry - immuno fluorescence, immuno enzymatic and immune electron microscopy. solation of pure antibody, assays of circulating immune complexes; Isolation of lymphocyte populations. Vaccine Types- Preparation of vaccines.	K1-K3	14
Course Outcome	**CO1:** Remember the knowledge about cells of the immune systems and their processes.	K1	
	CO2: Understand the functions of humoral immunity.	K2	
	CO3: Understand the functions of cellular immunity.	K2	
	CO4: Compare the Knowledge about the immunological reactions.	K2	
	CO5: Apply the various immunological techniques.	K3	

Learning Resources

Text Books	1. Owen,J.,Punt,JandStrandford,S."KubyImmunology", 7th Ed., W.H.Freeman Publication, NewYork, USA, 2012. 2. Abbas, K.A.,Litchman, A.H.andPober,J.S."CellularandMolecularImmunology", 4th Ed., W.B.Saunders Co., Pennsylvania, USA, 2005. 3. Talwar, G. P. and Gupta S. K. A "Hand book of practical and clinical immunology"Vol. I & II. CSB Publications, New Delhi, 1992
Reference Books	1. Roitt, I., Brostoff, J. and David, M. "Immunology", 6th Ed., Mosby publishers Ltd., New York, USA, 2001. 2. Tizard, R.I. "Immunology", 4th Ed., Saunders college publishing, Chennai Micro print Pvt. Ltd., Chennai, 2004.

Website Link	1. https://www.elsevier.com/books/bacterial-physiology-and metabolism/sokatch/978-1-4832-3137-2. 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

M.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards													
Course Code	**Course Title**				**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**	
21M1PMIC02	**IMMUNOLOGY AND IMMUNOTECHNOLOGY**				**DSC THEORY - II**		**I**	**5**	**5**			**4**	
CO-PO Mapping													
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	S	M	S	S	M	S	M	M	S	S			
CO2	S	M	S	S	M	S	M	M	S	S			
CO3	S	M	S	S	M	S	M	M	S	S			
CO4	S	M	S	S	M	S	M	M	S	S			
CO5	S	S	S	S	S	S	S	M	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, Video presentation												
Assessment Methods	Unit Test, Class Test, Assignment, Internal Examination, Model Presentation												
Designed By	**Designed By**				**Verified By**			**Approved By**					
Dr.A.K.Saravanan	Dr.A.K.Saravanan				Dr.M.Selvan								

MUTHAYAMMAL COLLEGE OF ARTS & SCIENCE
RASIPURAM 637 408 Tamil Nadu

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PMIC03	CELL AND MOLECULAR BIOLOGY	DSC THEORY - III	I	5	5			4
Objective	To enable the students to understand the basic knowledge of Cell structure, division, molecular structures and their mechanisms							

Unit	Course Content	Knowledge Levels	Sessions
I	**Cell Structure Permeability and Transport:** Prokaryotes, Development of multicellular organisms, Cell wall structure of bacteria and eukaryotes, Plasma membrane structure and models, cell organelles; cell permeability-concentration gradient and partition coefficient, transport of small molecules- active, passive, ion channels, facilitated diffusions.	K1-K2	12
II	**Cell division, Cell signaling and protein localization:** Cell cycle and its regulation, Bacterial cell division, Eukaryotic cell division, mechanics of cell division - mitosis and meiosis; Cell signaling – signaling molecules, G protein coupled receptors, Ion-channel receptors, enzyme linked receptors, protein sorting, nuclear localization, mitochondria and chloroplast import and export mechanism.	K1-K2	12
III	**Molecular structures of genes and chromosomes**: Structure of DNA - DNA melting and reannealing, base composition and sequence, size, shape, super twisting; molecular events of prokaryotic and eukaryotic chromosome organization, exon, intron - DNA mutation and repair mechanism.	K1-K2	12
IV	**Replication and Transcription**: Basic rules of replication- genes and enzymology of replication, processivity and fedility of replication, rolling circle replication, termination of replication, importance of teleomerase in eukaryotic replication- gene transfer mechanism in bacteria; Molecular events of Prokaryotic and Eukaryotic Transcription; initiation, elongation and termination.	K1-K2	12
V	**Gene expression and regulation:** Genetic code, Ribosome of prokaryote and eukaryote and its evolutionary importance; mechanism of translation-initiation, elongation and termination. Inhibitors of Translation. Post translational modification. Regulation of gene expression – lac operon, trp operon, ara operon.	K1-K2	12
Course Outcome	**CO1:** Remember the knowledge on general Cell Structures and Molecular practices.	K1	
	CO2: Understand about the cell signaling and communications.	K2	
	CO3: Understand the knowledge about the biomolecules and their mechanisms.	K2	
	CO4: Summarize the knowledge about DNA replication and transcription process.	K2	
	CO5: Interpret about the gene expression.	K2	

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.
3. Lodish, H., Berk, A., Zipurursky, S. L., Matsudaria, P., Baltimore D, and Darnell, J, "MolecularCellBiology",W.H.Free Manand Company, England,2000.
4. Benjamin Lewin,"GeneIX",OxfordUniversityPress, NewDelhi,India,2000.

Reference Books	1. Stanly R Maloy, John E Cronan Jr. and David Freifelder. Microbial Genetics, 2nd edition, Narosa publishing house, New Delhi. 2006. 2. Roitt, I., Brostoff, J. and David, M. "Immunology", 6th Ed., Mosby publishers Ltd., New York, USA, 2001. 3. Tizard, R.I. "Immunology", 4 th Ed., Saunders college publishing, Chennai Microprint Pvt.Ltd., Chennai, 2004
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

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

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PMIC03	CELL AND MOLECULAR BIOLOGY	DSC THEORY - III	I	5	5			4

CO-PO Mapping

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

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

M.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M1PMIP01	**Practical: GENERAL MICROBIOLOGY AND IMMUNOLOGY**	**DSC PRACTICAL - I**	**I**	**6**	**-**	**-**	**6**	**3**
Objective	The learners will be able to gain adequate knowledge and acquire skill to perform different staining techniques, growth rate of bacteria, biochemical test and immunological techniques							

S.No.	List of Experiments / Programmes	Knowledge Levels	Sessions
1	Measurement of microorganisms – Micrometry	K1-K3	3
2	Staining methods - Gram Staining, Acid fast, Metachromatic granular Staining, Spore Staining, Capsule Staining and Flagella staining.	K3	6
3	Motility Determination – Hanging drop method and Soft agar	K3	3
4	Media preparation - Cultural Characters of bacteria on different types of Media - Selective, Differential, Enriched, Enrichment and Transport media	K2-K5	3
5	Pure culture techniques - Streak plate, Pour plate and Spread plate	K2-K5	3
6	Bacterial Growth - Growth curve and Effect of various intrinsic factors such as pH, Temperature on the growth of bacterium-Spectroscopic method.	K2-K5	3
7	Anaerobic cultivation - Anaerobic gas pack method (Demo), Wright's tube method	K2-K5	3
8	Algae - Isolation and cultivation of Algae	K1-K3	3
9	Fungi - Fungal Slide Culture, Lactophenol Cotton Blue Staining	K2-K5	3
10	Study on bacterial extra cellular enzymes - Starch, Casein, Gelatin and Lipid hydrolysis	K5	3
11	Biochemical Tests for identification of bacteria • Oxidase test • Catalase test • Coagulase test • Nitrate reduction test • Carbohydrate fermentation test • IMViC test • TSI test • Urease test • Amino acid decarboxylation test • Urease test • Amino acid decarboxylation test	K2-K5	6
12	Antibiotic sensitivity methods – Kirby-Bauer method and Stokes method	K2-K5	3
13	Fumigation technique.	K1-K2	2
14	ABO Blood grouping – Rh typing and cross matching	K2-K5	1

15	Agglutination tests • WIDAL • RA • ASO • CRP • Beta-HCG	K2-K5	6
16	Precipitation • Ouchterlony's Double Immuno – diffusion test • Counter Immuno electrophoresis • Rocket Immuno electrophoresis • Radial Immuno electrophoresis	K2-K5	6
17	Rapid plasma reagin test (RPR)	K2-K5	3
18	ELISA (HIV & HBs ag)	K2-K5	3
Course Outcome	**CO1:** Remember the various staining techniques of bacteria and study the growth rate of bacteria.	K1	
	CO2: Understand the knowledge about the various methods to isolate and identify the Microorganisms.	K2	
	CO3: Apply the various biochemical test for identifications of bacteria	K3	
	CO4: Analyze and evaluate the principles of different immunological tests	K4	
	CO5: Compare the different immunological test in diagnosis of diseases	K5	

Learning Resources

Text Books	1. James G. Cappuccino and Natalie Sherman (2014) Microbiology: A Laboratory Manual (10th Edition), Pearson. 2. Sundaraj T, Aswathy Sundarraj (2002), Microbiology Laboratory Manual (First edition), Chennai.
Reference Books	1. Aneja, K.R (2003) Experiments in Microbiology, Plant Pathology and Biotechnology (4th edition), New age 2. Dubey, R.C and Maheshwari, O.K (2005) Practical Microbiology, S Chand and Co. Ltd., (First edition), New Delhi. 3. Alfred E. Brown (2010) Benson's Microbiological Applications: Laboratory Manual in Generl Microbiology, 11th Edition, McGraw-Hill Companies. 4. Kocher, G.S. (2013) Practical Manual Series Vol III: Practical Teaching in Microbiology HB, NPH Publishers and Distributors.
Website Link	1. http://www.pdfsdocuments.com/cp-baveja-microbiology.pdf 2. http:/www.faculty.washington.edukorshin/Class486/MicrobiolTechniques.pdf 3. http://www.microbiologyonline.org.uk/media/.../sgm_ basic practical micro biology_2.pdf 4. http://www.cmu.edu.cn/jc_sys1/upl_files/200858184159474.pdf

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

M.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M1PMIP01	**Practical: GENERAL MICROBIOLOGY AND IMMUNOLOGY**		**DSC PRACTICAL - I**		**I**	**6**	**-**	**-**	**6**	**3**
CO-PO Mapping										
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	S	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	M	S	S
CO5	S	S	S	S	S	S	S	M	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	Dr.M.Selvan	

04/02/23

Curriculum Development Cell MCAS Autonomous Rasipuram

M.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M1PMIP02	**Practical: CELL AND MOLECULAR BIOLOGY**	**DSC PRACTICAL - II**	**I**	**3**	**-**	**-**	**3**	**2**
Objective	The learners will be able to gain adequate knowledge and acquire skill to perform various techniques in molecular biology							

S.No.	List of Experiments / Programmes	Knowledge Levels	Sessions
1	Identification of different stages of mitosis in *Allium cepa* (Onion) by staining	K2-K4	3
2	Isolation of genomic DNA from bacterial cells	K2-K4	6
3	Extraction of genomic DNA from yeast cells.	K1-K3	3
4	Isolation of genomic DNA from blood by high salt method.	K1-K3	5
5	Isolation of genomic DNA from plants by CTAB method.	K1-K3	2
6	Extraction of plasmid DNA from bacterial cells.	K2-K4	2
7	Isolation of total RNA from prokaryotes.	K1-K3	6
8	Quantification of DNA by UV spectrometer.	K4	3
9	Isolation of drug resistant mutants by gradient plate technique.	K4	3
10	Size determination of DNA agarose gel electrophoresis.	K2-K4	3
11	Ames test.	K1-K2	3
12	Bacterial conjugation.	K1-K2	3
13	Bacterial transformation.	K1-K2	3
14	Isolation of Bacteriophage from sewage.	K2-K3	3
Course Outcome	**CO1:** Remember the knowledge about the cell division in onion root.	K1	
	CO2: Understand the knowledge about the Isolation of genomic DNA, plasmid DNA and RNA from Bacteria and yeast.	K2	
	CO3: Apply the quantification of DNA.	K3	
	CO4: Apply the isolated DNA in rDNA technology	K3	
	CO5: Analyze the various methods in sewage treatment	K4	

Learning Resources

Text Books	1. Sam brook, J., Russsel, D.W., 'Molecular cloning – A laboratory manual', Third edition, Cold spring Harbor Laboratory Press, Cold spring Harbor, New York, USA, 2001. 2. Ansubel, F.M., Brent, R., Kingston, R.e., and Moore, D.D., 'Current protocols in Molecular Biology', Geone publication associates, New York, USA, 2001.
Reference Books	1. Aneja KR (2005). Experiments in 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. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. Sixth edition, Published by Pearson Education. 4. Kannan N (2003). Handbook of laboratory culture media, Reagents, Stains and buffers. Panima Publishing Corporation, NewDelhi.

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

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

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M1PMIP02	Practical: CELL AND MOLECULAR BIOLOGY	CORE PRACTICAL - II	I	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	M	M	S	S
CO2	S	M	S	S	S	S	S	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	-		
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.Sankareswaran	Dr.M.Selvan	

Curriculum Development Cell MCAS (Autonomous) Rasipuram

07/02/23

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PMIE01	INHERITENCE BIOLOGY	DSE - I	I	6	L			4
Objective	The course is designed to develop the student with enough knowledge about genetic field.							
Unit	Course Content						Knowledge Levels	Sessions
I	**Mendelian principles:** Dominance, segregation, independentassortment. Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.						K1-K2	17
II	**Gene mapping methods**: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population inplants.Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.						K1-K2	15
III	**Microbial genetics**: Methods of genetic transfers – transformation, conjugation, transduction and sex- duction, mapping genes by interrupted mating, fine structure analysis of genes. **Human genetics:** Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.						K1-K2	15
IV	**Quantitative genetics:** Polygenic inheritance, heritability and its measurements, QTL mapping. **Mutation:** Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.						K1-K2	15
V	**Structural and numerical alterations of chromosomes**: Deletion, duplication, inversion, translocation, ploidy and their geneticimplications.Recombination: Homologous and non-homologous recombination including transposition.						K1-K2	13
Course Outcome	**CO1:** Remember the knowledge about basic principles of genes.						K1	
	CO2: Understand the knowledge about the various gene mapping.						K2	
	CO3: Summarize about the gene transformation and human genetics.						K2	
	CO4: Illustrate the knowledge about the mutation and mutagenesis.						K2	
	CO5: Interpret about the structural alteration in chromosomes.						K2	
Learning Resources								
Text Books	1. Alberts B, Bray D, Johnson A et al. (1997) Essential Cell Biology. London: Garland Publishing 2. Watson JD, Hopkins NH, Roberts JW et al. (1987) Molecular Biology of the Gene, 4th edn. Menlo Park, CA: Benjamin-Cummings							
Reference Books	1. Darwin C (1859) On the Origin of Species. London: Murray. 2. Graur D & Li W-H (1999) Fundamentals of Molecular Evolution, 2nd edn. Sunderland, MA: Sinauer Associates. 3. Madigan MT, Martinko JM & Parker J (2000) Brock's Biology of Microorganisms, 9th edn. Englewood Cliffs, NJ: Prentice Hall. 4. Margulis L & Schwartz KV (1998) Five Kingdoms: An Illustrated Guide to the Phyla of Life on Earth, 3rd edn. New York: Freeman							

Website Link	1.https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/08%3A_Inheritance/8.3%3A_Genetics_of_Inheritance 2.https://www.nature.com/scitable/topicpage/inheritance-of-traits-by-offspring-follows-predictable-6524925/ 3.https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/08%3A_Inheritance/8.4%3A_Simple_Inheritance			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

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

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PMIE01	INHERITENCE BIOLOGY	DSE - I	I	6	6			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M	S	M	L	L	M
CO2	S	M	S	S	S	S	M	M	M	M
CO3	S	M	S	S	S	S	M	M	L	M
CO4	S	M	S	S	S	S	M	M	M	S
CO5	S	M	S	M	M	S	M	M	M	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, Video presentation
Assesment Methods	Unit Test, Class Test, Assignment, Internal Examination, Model Presentation

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

MUTHAYAMMAL COLLEGE OF ARTS & SCIENCE
RASIPURAM
637 408
Tamil Nadu

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIC04	**MEDICAL BACTERIOLOGY AND MYCOLOGY**	**DSC THEORY- IV**	**II**	**5**	5	-	-	**5**
Objective	Gain wide information regarding various types of bacterial and fungal infections, diagnosis, treatment and prevention							

Unit	Course Content	Knowledge Levels	Sessions
I	Indigenous normal microbial flora of human body. General attributes and virulence factors of bacteria causing infections. Host Parasite relationships – Non-specific host immune mechanisms. Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis and discarding of clinical Specimens.	K1-K2	12
II	Morphology, classification, cultural characteristics, pathogenicity, pathology, laboratory diagnosis and prevention – Control and treatment of diseases caused by the Following organisms: *Staphylococci, Streptococci, Pneumococci, Neisseriae* (Gonococci & Meningococci), *Corynebacterium diptheriae, Mycobacterium tuberculosis, M. leprae, Clostridium tetani, Cl. botulinum* and *Bacillus anthracis.*	K2-K4	12
III	Morphology, classification, cultural characteristics, pathogenicity, pathology, Laboratory diagnosis and prevention – *Salmonella, Shigella dysenteriae, Vibrio cholerae, E. coli, Pseudomonas aeruginosa, Haemophilus influenzae, Helicobacter pylori, Brucella abortus, Bordetella. Spirochetes, Rickettsiae rickettsi, Chlamydiae trachomatis* and *Mycoplasmas* – Emerging Bacterial infections, Zoonotic diseases and their control – Hospital acquired infections – Hospital Infection control committee – functions – Hospital waste disposal – Ethical committee – functions.	K2-K4	12
IV	Classification of medically important Fungi (Morphology, Infection & Reproduction), Immunity to Fungal Infections. Culture Media and Stains in Mycology, Normal fungal flora of human beings, Specimen collection, preservation, Transportation & Identification of Mycological Agent. Biochemical tests for fungal identification, Anti fungal agents- sensitivity test	K1-K2	12

V	Pityriasis vesicolor, White piedra, Black piedra, Tinea nigra, Cutaneous mycosis- Dermatophytes. Subcutaneous Mycosis – Mycetoma, Sporotrichosis, Chromoblastomycosis, Systemic Mycosis - Histoplasmosis, Blastomycosis, Coccidiodomycosis, Paracoccidioides brasiliensis. Opportunistic Mycosis – *Cryptococcus neoformans*. Candidiasis, Aspergillosis, Miscellaneous Mycosis- Otomycosis. Fungal infections in eyes. Mycotoxins. Allergic Fungal diseases - Mycetismus.	K2-K4	12
Course Outcome	**CO1:** Remember about the normal flora of human beings.	K1	
	CO2: Understand more knowledge about the various bacterial infections.	K2	
	CO3: Interpret the knowledge about the various bacterial infections.	K3	
	CO4: Compare the knowledge about medically important fungal diseases.	K4	
	CO5: Compare the knowledge about medically important fungal diseases.	K4	

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. 3. Willey JM, Sherwood LM, and Woolverton CJ. (2017) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.
Reference Books	1. Tortora GJ, Funke BR, and Case CL. (2016). Microbiology: An Introduction. 11th edition Pearson Education India. 2. Chakraborty P (2003). A text book of Microbiology. Second edition, Published by New central book agency (P) Ltd., Kolkata. 3. Monica Cheesbrough. (2003). District Laboratory Practice in Tropical Countries. Part 1 & 2 Low-Price edition, Cambridge University Press. 4. Jagadish Chander (1996). A Text Book of Medical Mycology. Interprint, New Delhi.
Website Link	1. https://mechpath.com/2015/12/01/mycobacterium-leprae/ 2. https://www.slideshare.net/El_Omda/anthrax-15737452 3. https://mycology.adelaide.edu.au/ 4. https://en.wikipedia.org/wiki/Opportunistic_infection

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

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards											
Course Code	**Course Title**				**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIC04	**MEDICAL BACTERIOLOGY AND MYCOLOGY**				**DSC THEORY- IV**		**II**	**5**	**5**	**-**	**-**	**5**
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, Video presentation											
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE											

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

Curriculum Development Cell MCAS (Autonomous) Rasipuram

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIC05	**INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY**	**DSC THEORY- V**	**II**	**5**	5	-	-	**5**
Objective	To understand the basic information about the industrially important microorganisms							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction to fermentation** – the range of fermentation process. The chronological development of the fermentation industry. The component parts of a fermentation process. Industrially important organisms – Isolation, preservation and strain improvement.	K1-K3	12
II	**Development of inoculums - Scale up (Pilot study)** – Upstream processing, media for industrial fermentation – formulation, sterilization, Microbial growth kinetics. Fermentation – types. Downstream processing. Fermentor – parts, design, types, Instrumentation and control.	K1-K2	12
III	Microbial production of organic acids (Citric acid, Acetic acid, Lactic acid and Itaconic acid), Amino acids (L-Glutamic acid and L - Lysine), Antibiotics (Penicillin, Semi synthetic penicillins, Streptomycin, Tetracyclines and Griseofulvin), enzymes (Amylases, Proteases and Pectinases), vitamins (B12, B2 and C), alcoholic beverages. Microbial transformations – steroids, sterols, antibiotics and pesticides. Water analysis.	K1-K3	12
IV	Production of vaccines, toxoid, antisera and their standardization. Antiseptics, disinfectants and their standardization. Types of water (DM/Purified water/water for injection) used in pharmaceutical industry. Environmental monitoring. Growth promotion test. Sterility sample analysis. Biological Indicators.	K1-K3	12
V	Sub culturing and culture suspension preparation. Microbial assay of antibiotics and vitamins. Sterility testing. Bacterial Endotoxin Test (BET). Microbial limit test. Validation of instruments (Laminar air flow, autoclave and Hot air oven). Good Documentation Practice (GDP) – SOP – GLP. Failure investigation. Different types Incubators.	K1-K3	12

Course Outcome	**CO1:** Remember the knowledge about the components and industrial microorganisms.	K1	
	CO2: Understand the knowledge about the scale up studies.	K2	
	CO3: Apply the methods of production of various industrial products.	K3	
	CO4: Analyze the production of pharmaceutical products.	K4	
	CO5: Evaluate about the industrial documentation policies.	K5	

Learning Resources	
Text Books	1. Stanbury, P.F., Whittaker, A and Hall, S.J., (1995) Principles of fermentation technology, Elsevier; 3rd edition. 2. Crueger and Crueger, A., Biotechnology: A text book of Industrial Microbiology, Sinavos association, Ino Sundeland; 2nd edition. 3. Cassida, J.E., (1968).Industrial Microbiology, New Age International (2007).
Reference Books	1. Presscott and Dunn, S.,(1982)Industrial Microbiology. The AVI Publishing Company Inc., USA; 4th edition. 2. Peppler, H.J. and Pearlman, D.(1979). Microbial Technology, Vol1and2, Academic press. 3. Demain, A. L. and Solomon INA, (1986). Manual of Industrial Microbiology and Biotechnology, American society for Microbiology, Washington DC. 4. Chisti,Y., Fermentation, Biocatalysis and bioseparation, Encyclopedia of Bioprocess Technology,Vol.5,John Wiley and Sons, N.Y.
Website Link	1. https://www.scribd.com/document/322795616/Free-Download-Indian- Pharmacopoeia-2010-PDF 2. https://www.pharmacy180.com/group/pharmaceutical-microbiology-28/ 3. https://pharmaceutical-microbiology.imedpub.com/

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

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIC05	**INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY**		**DSC THEORY - V**		**II**	**5**	**5**	**-**	**-**	**5**
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, Field visit, model preparation and Kahoot app,									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, Video presentation									
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE									
Designed By	**Verified By**							**Approved By**		
Mr.N.Radhakrishnan	Dr.M.Selvan									

Curriculum Development Cell MCAS (Autonomous) Rasipuram

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIC06	**GENETIC ENGINEERING AND ADVANCES IN BIOTECHNOLOGY**	**DSC THEORY- VI**	**II**	**5**	**5**	**-**	**-**	**5**
Objective	To learn the basics of recombinant DNA technology							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction to Genetic Engineering**: Definition, Historical perspectives. Enzymes in rDNA technology - Restriction enzymes – types – nomenclature. DNA ligase. DNA modifying enzymes – alkaline phosphatase and polynucleotide kinase - Polymerases and types- Conversion of blunt ended molecules to sticky ended- linkers – adopters – homopolymer tailing.	K1-K2	14
II	**Cloning Vectors:** Cloning vectors: Bacterial Plasmids- pBR322 & pUC vectors, Bacteriophage vectors λ, M13, Hybrid vectors- cosmid, phagemid. Yeast vectors- YEP, YRP, YIP & YAC. Shuttle vectors. Expression vectors for expressing eukaryotic gene.	K1-K2	12
III	**Cloning Strategies:** Construction of cDNA and genomic libraries. Gene transfer methods – transformation, electroporation, particle bombardment and micro injection. Screening and selection of clones.	K1-K3	10
IV	**Transgenic Animals and Plants:** Animal vectors – SV 40, Retroviral vector. Production and applications of transgenic mice. Gene transfer to plants- Callus culture, *Agrobacterium* mediated transformation: Crown gall disease, Ti plasmids, T-DNA transfer, Ti plasmid derivatives- co-integrate vectors and binary vectors.	K1-K2	12
V	Blotting techniques – Southern, Northern and Western blotting. PCR amplification and its application. DNA sequencing methods – dideoxy, chemical and Next Generation Sequencing (NGS), RFLP, RAPD, Microarray. Applications of Genetic Engineering in Medicine and Agriculture.	K1-K3	12
Course Outcome	**CO1:** Remember about the importance of various enzymes in genetic engineering field.	K1	
	CO2: Understand about the different vector used in gene cloning.	K2	
	CO3: Interpret about the cloning strategies.	K3	
	CO4: Analyze the knowledge about transgenic animals and plants.	K4	

	CO5: Compare the knowledge about recombinant DNA technology.			K5	
Learning Resources					
Text Books	1. Brown, T.A. 1995.Gene Cloning–An Introduction. [Third Edition]. Chapman and Hall, UK. 2. Old, R.M. and Primrose, S.B. 1995. Principles of Gene Manipulation. [Sixth Edition]. Blackwell Scientific Publication, London.				
Reference Books	1. Glick, B.K. and Pasternik, J.J. 1998. Molecular Biotechnology. Principles and applications of recombinant DNA. [Second Edition]. ASM Press, Washington DC, USA. 2. Winnacker, E.L. 1987. From Genes to Clones. Introduction to Gene technology. [First Edition]. Panima Publishing Corporation, New Delhi.				
Website Link	1. https://byjus.com/free-ias-prep/genetic-engineering/ 2. https://www.genome.gov/genetics-glossary/Genetic-Engineering 3. https://www.khanacademy.org/science/ap-biology/gene-expression-and-regulation/biotechnology/a/intro-to-biotechnology				
	L-Lecture	T-Tutorial	P-Practical	C-Credit	

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards												
Course Code	**Course Title**				**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIC06	**GENETIC ENGINEERING AND ADVANCES IN BIOTECHNOLOGY**				**DSC THEORY- VI**			**II**	**5**	**5**	**-**	**-**	**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, Video presentation												
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE												
Designed By	**Verified By**									**Approved By**			
Dr.M.Sankareswaran	Dr.M.Selvan												

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIP03	**PRACTICAL - MEDICAL BACTERIOLOGY AND MYCOLOGY**	**DSC PRACTICAL - III**	**II**	**3**	**-**	**-**	**3**	**2**
Objective	The learners will be able to gain knowledge and understanding of practical skills in applying these principles in diagnostic, therapeutic techniques and research							

S.No.	List of Experiments / Programmes	Knowledge Levels	Sessions
1	Preparation of cotton swab and sterile container for clinical sample collection	K2	3
2	Collection of clinical specimens (Throat swab, pus sample, sputum, urine and stool sample)	K2-K4	3
3	Microscopic examination of wet film (*V.cholerae*)	K1-K2	3
4	Preparation of Stains for bacterial and fungal observation	K5	3
5	Staining methods a) Gram staining b) AFB staining c) Capsule staining d) Spore staining e) Granular staining (Demo) f) Flagella (Silver staining) (Demo) g) Nuclear staining (Demo)	K5	6
6	Biochemical reactions for identification of pathogenic bacteria *a) S. aureus,* *b) E. coli,* *c) K. pneumoniae,* *d) P. aeroginosa* *e) S. typhi,* *f) Shigella dysentriae,* *g) Proteus vulgaris,* *h) V. cholerae*	K5	6
7	Kirby - Bauer (AST) antibiotic sensitivity test	K5	3

8	KOH, KOH-DMSO Mount, Indian Ink/LPCB preparation of Skin/hair/nail for fungal observation	K1-K5	3
9	Microscopic identification of fungi (*Penicilliu sp, Aspergillus sp, Mucor sp, Rhizopus sp, Fusarium sp, Trichophyton sp, Microsporum sp,* and *Epidermophyton sp,)*	K5	6
10	Slide culture method	K1-K5	3
11	Cultivation of Yeast (*Candida & Cryptococcus*) (Demo)	K1-K3	3
12	Biochemical identification *Candida sp,*	K1	3
13	Germ tube technique	K2-K5	1
14	Antibiotic sensitivity test for fungi (Demo)	K2-K5	3
Course Outcome	**CO1:** Remember the knowledge about the various staining techniques of bacteria and study the Isolation from various samples	K1	
	CO2: Understand the various methods to isolate and identify the Microorganisms from clinical samples and antimicrobial activity.	K2	
	CO3: Apply the knowledge about the various fungi observation and slide culture techniques.	K3	
	CO4: Analyze the knowledge about the cultivation and identification of yeast cells.	K4	
	CO5: Evaluate the knowledge about the antifungal activity.	K5	

Learning Resources

Text Books	1. Dubey, R.C. and Maheshwari, D.K. (2002) Practical Microbiology, 1st Edn. S. Chand & Co. Ltd., New Delhi. 2. Cappuccino, J. and Sherman, N. (2002) Microbiology: A Laboratory Manual, 6th Edn. Pearson Education Publication, New Delhi. 3. Collee, J.C., Duguid, J.P., Fraser, A.C. and Marimon, B.P. (1996) Mackie and McCartney Practical Medical Microbiology, 14th Edn. Churchill Livingstone, London.
Reference Books	1. Cowan and Steel (1995) Manual for Identification of Medical Bacteria, 4th Edn. Cambridge University Press, London. 2. Murray, P.R., Baron, E.J., Jorgensen, J.H., Pfaller, M.A. and Yoke, R.H. (2003) Manual of Clinical Microbiology, 8th Edn. Vol 1&2, ASM Press, Washington, D.C 3. Balows, A., Hausler. W.J., Ohashi.M and Turano.A. (Eds) (1988) Laboratory Diagnosis of Infectious Diseases: Principles and Practice, Vol 1 Springer Verlag, New York.
Website Link	1. https://learn.chm.msu.edu/vibl/ 2. https://www.microrao.com/

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code	**Course Title**				**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIP03	**Practical - MEDICAL BACTERIOLOGY AND MYCOLOGY**				**DSC PRACTICAL - III**	**II**	**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
Mrs.N.Sathyabama	Dr.M.Selvan	

Curriculum Development Cell MCAS (Autonomous) Rasipuram

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIP04	**PRACTICAL - GENETIC ENGINEERING AND INDUSTRIAL MICROBIOLOGY**	**DSC PRACTICAL - IV**	**II**	**6**	**-**	**-**	**6**	**3**
Objective	To understand the basic information on bacterial and fungal industrial products. Important knowledge on microbial products. Create knowledge on Genetic Engineering Techniques							

S.No.	List of Experiments / Programmes	Knowledge Levels	Sessions
1	Isolation of chromosomal DNA from bacteria	K2-K3	3
2	Isolation of plasmid DNA	K2-K3	2
3	Restriction digestion of λ DNA (EcoR1 and BamH1) and ligation	K1-K2	2
4	Bacterial transformation, competence cell preparation	K1	5
5	SDS -PAGE	K2-K3	2
6	Protein estimation by Lowry *et al.*, method	K1	2
7	Western blotting	K1-K3	3
8	Southern blotting	K1-K3	3
9	Separation of biomolecules by paper, thin layer and column chromatography	K2-K5	9
10	Polymerase chain reaction	K1	3
11	Plant tissue culture – Explants preparation, Callus formation in MS media	K1	3
12	Screening of antibiotics producing microbes from soil	K2-K3	6
13	Production of microbial enzymes a).Solid state fermentation (Any one enzyme) b).Submerged fermentation (Any one enzyme)	K2-K3	6
14	Assay of enzymes a). Amylase b). Protease c). Lipase	K2-K3	6
15	Immobilization of cells and enzymes	K1	3
16	Microbial production of wine	K2-K3	3
17	Citric acid production using *Aspergillus niger*	K1	3
18	Minimal inhibitory concentration (MIC) determination of antibiotics – Broth Dilution	K1-K3	3

19	Minimal inhibitory concentration (MIC) determination of antibiotics–Filter paper disc assay	K1-K3	3
20	Evaluation of disinfectants–Filter paper disc assay	K1-K3	3
21	Phenol co–efficient test	K1-K3	3
22	Vitamin assay (B12/Nicotinic acid)	K1	3
23	Sterility testing of pharmaceutical products (Membrane filter assay – Fluid thioglycollate medium) (Demo)	K1	3
24	Bacterial Endotoxin Test–Limulus Amoebocyte Lysate (LAL) assay (Demo)	K1	3
Course Outcome	**CO1:** Remember the wide information for isolation, separation of molecules.	K1	
	CO2: Understand the knowledge about the Plant tissue culture method.	K2	
	CO3: Apply the knowledge about production of various metabolites, enzymes, acids and antibiotic screening methods.	K3	
	CO4: Compare the knowledge on laboratory techniques and screening of various microbial products important in commercial products.	K4	
	CO5: Evaluate the knowledge about the Pharmaceutical methods.	K5	

Learning Resources

Text Books	1. Rajan S and Selvi Christy (2011). Experimental procedures in life sciences. Anjana Book House, publishers and distributors, Chennai. 2. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th edition, New Age International Publishers, Chennai. 3. Stanbury, P.F., Whittaker, A and Hall, S.J., (1995) Principles of fermentation technology, Elsevier; 3rd edition.
Reference Books	1. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. Sixth edition, Published by Pearson Education. 2. Kannan. N (2003). Handbook of laboratory culture media, Reagents, Stains and buffers. Panima Publishing Corporation, New Delhi. 3. Cassida, J. E., (1968).Industrial Microbiology, New Age International (2007).
Website Link	1. https://www.britannica.com/science/genetic-engineering 2. https://www.labster.com/microbiology-virtual-labs/ 3. https://onlinecourses.nptel.ac.in/noc22_bt59/preview

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards												
Course Code	**Course Title**					**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIP04	**Practical - GENETIC ENGINEERING AND INDUSTRIAL MICROBIOLOGY**					**DSC PRACTICAL - IV**	**II**	**6**	**-**	**-**	**6**	**3**
CO-PO Mapping												
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**		
CO1	S	M	S	S	S	S	M	M	S	S		
CO2	S	M	S	S	S	S	M	M	S	S		
CO3	S	S	S	S	S	S	M	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	-											
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.Sankareswaran	Dr.M.Selvan											

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIED1	**INFECTIOUS DISEASES AND DIAGNOSTICS**	**EDC**	**II**	**5**	**5**	**-**	**-**	**4**
Objective	To understand the medically important bacteria, fungi, virus parasites and its diagnosis							

Unit	Course Content	Knowledge Levels	Sessions
I	Scope and relevance of Microbiology - Definition and concepts, Type of microorganism, Distribution of Microorganism in nature; Development of Microbiology as a Scientific discipline; General characteristics of microorganisms - General principles, Taxonomy, classification and structural organization of Bacteria, Fungi, Viruses, Algae, *Actinomycetes, Mycoplasma*, and *Ricketssiae;* Microscopy-Principles and applications.	K1-K2	12
II	Fixatives and Fixation of smears, Stains - Definition, Acidic, Basic stains, simple and differential staining, use and significance of stains in microbiology; cultivation of microorganism- Pure culture techniques; cultivation of anaerobes; control of microorganism-sterilization by physical and chemical methods, Antiseptics	K2-K3	12
III	Binomial nomenclature; Outline classification of living organisms-Haeckel, Whittaker, and woese system, normal micro flora in human body and their beneficial effects; Lymphoid organs and types of immunity; General principles of diagnostic microbiology - collection, transport, and processing of clinical specimens, General methods of laboratory diagnosis-cultural, biochemical, serological, and molecular methods.	K3	12
IV	Host pathogen interaction- virulence factors, General account of the following diseases - Causal organisms, pathogenesis, diagnosis, prevention and therapy of Typhoid, cholera, dysentery, whooping cough, tuberculosis, Malaria, small pox, and AIDS. General account of Nosocomial Infections and prevention.	K3- K4	12
V	Antimicrobial therapy in the diagnosis of diseases; In vitro diagnostic methods- agglutination, precipitation, immunofluoresence, ELISA, Skin test; Vaccines: Principles underlying the preparation of live and attenuated vaccines. Immunization; Automation in Disease diagnosis.	K4	12
Course	**CO1:** Remember the knowledge about infectious agents.	K1	

Outcome	**CO2:** Understand the knowledge about identification of infectious agents.	K2	
	CO3: Illustrate the knowledge about classification and diagnosis of infectious agents.	K3	
	CO4: Summarize the Pathogenesis of medically important bacteria and virus.	K4	
	CO5: Summarize the knowledge about diagnosis and preventive measures	K4	

Text Books	1. Morag, C. and Timbury, M.C. (1994) Medical Virology, 10th Edn. Churchill Livingston, London. 2. Dimmock, N.J. and Pimrose, S.B. (1994) Introduction to Modern Virology, 4th Edn. Blackwell Scientific Publications, Oxford.
Reference Books	1. Conrat, H.F., Kimball, P.C. and Levy, J.A. (1994) Virology, 3rd Edn, Prentice Hall, New Jersey. 2. Maloy SR,Cronan Jr.JE, Freifelder D. (1998). Microbial Genetics. Jones and Bartlett publishers. 3. Robert G. Welstar and Allan Garnoll. Encyclopaedia of Virology (1994). Vol. I, II &III Academic Press inc. San Diego, CA 92101. Ed.
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

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards													
Course Code	**Course Title**				**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
21M2PMIED1	INFECTIOUS DISEASES AND DIAGNOSTICS				EDC		II	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	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, Video presentation												
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE												
Designed By	**Verified By**									**Approved By**			
Dr.S.Anbalagan	Dr.M.Selvan									A. Anbalagan			

Curriculum Development Cell MCAS Autonomous Rasipuram

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3PMIC07	MEDICAL VIROLOGY AND PARASITOLOGY	DSC THEORY - VII	III	5	5			5
Objective	The course is designed to develop the student with enough knowledge about disease caused by viruses and parasites							
Unit	Course Content						Knowledge Levels	Sessions
I	Brief outline on discovery of Viruses, nomenclature, ICTV classification of Viruses, General properties of Viruses. General methods of diagnosis and serology and molecular diagnosis, viriods, prions, Satellite RNAs and virusoids. Anti viral agents – Viral vaccines and Interferon.						K1-K2	11
II	Epidemiology, life cycle, pathogenicity, diagnosis, prevention and treatment of DNA Viruses. Pox virus – Variola, Herpes Simplex Virus – Varicella Zoaster virus, Adeno virus, Hepatitis virus- A & B, Cytomegalo virus, Epstein Barr virus, Oncogenic virus – Papilloma virus						K1-K2	12
III	Epidemiology, life cycle, pathogenicity, diagnosis, prevention and treatment of RNA Viruses. Picorna viruses – Polio virus, Orthomyxo virus – Influenza virus (H1NI1), Paramyxo viruses – Mumps virus, Measles virus, Rhabdo viruses - Rabies virus, Retro virus – HIV, Arbo viruses – Yellow fever virus, Dengue virus, Japanese B Encephalitis virus. Newly emerging viral diseases - SARS- MERS - Covid-19 - Avian flu- Ebola & Zika virus, Marbug-Nipah						K1-K2	12
IV	Introduction and classification of parasites - Laboratory diagnostic techniques in parasitology - Blood smear examination. Intestinal amoebae - *Entamoeba histolytica*. Free living amoebae - *Naegleria fowleri*. Intestinal and genital flagellates - *Giardia, Trichomonas*. Blood and tissue flagellates - *Leishmania donovani, Trypanosoma cruzi*. Haemosporina - Malarial parasites. Coccidian –*Toxoplasma*.						K1-K3	13
V	Helminthic Infections - Taenia solium, Echinococcus granulosus, Fasciola hepatica, Paragonimus westermani and Schistosomes, Ascaris lumbricoids, Ancylostoma duodenale, Trichuris triuchura, Enterobius vermicularis and Filarial nematodes Wuchereria bancrofti.						K1-K3	12
Course Outcome	**CO1:** Remember about the discovery and evolution of viruses.						K1	
	CO2: Understand about the concept and classification of DNA viruses.						K2	
	CO3: Compare the life cycle, pathogenicity mechanisms between RNA viruses.						K2	
	CO4: Apply the knowledge about the various diagnostic methods in protozoan parasites.						K3	
	CO5:– Apply the knowledge about the various diagnostic methods in helminthic parasites.						K3	
Learning Resources								
Text Books	1. Medical Parasitology, Rajesh Karyr karte, Ajit Damla, 2004. Books and allied publishers Ltd. Kolkata. 2. Textbook of Medical Parasitology, Subash O. Barija, 1996. First edition. All India Publishers and Distributors Regd. 920 Poonamallee High Road, Chennai. 3. Rajesh Karyakarte and AjithDamle (2005) Medical Parasitology, books and Allied (P)Ltd.							
Reference Books	1. Subhas Chandra Parija (2004). Text book of Medical Parasitology. Second edition, All India Publishers and Distributors, Medical Books Publishers, New Delhi. 2. Jayaram Paniker CK (2004). Text book of Medical Parasitology. Fifth edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi. 3. RatanLallchhpujani and Rajesh Bhatia (2004). Essentials of Medical Microbiology. Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.							

Website Link	1. http://dmoz.org/Science/Biology/Microbiology/ 2. http://microbiology.mtsinai.on.ca/manual/default.asp 3. http://cal.vet.upenn.edu/parasite/links.html			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

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

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3PMIC07	MEDICAL VIROLOGY AND PARASITOLOGY	DSC THEORY - VII	III	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	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, Video presentation
Assesment Methods	Unit Test, Class Test, Assignment, Internal Examination, Model Presentation

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

MUTHAYAMMAL COLLEGE OF ARTS & SCIENCE
RASIPURAM
637 408
Tamil Nadu

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3PMIC08	FOOD, DAIRY AND ENVIRONMENTAL MICROBIOLOGY	DSC THEORY - VIII	III	5	5			5

Objective	To learn about the microorganisms used in food, dairy and environmental microbiology		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Food Microbiology:** Food as a substrate for microbes. Microorganisms important in food microbiology. Factors influencing microbial growth in food. Extrinsic and Intrinsic factors. Sources of food contamination	K1-K2	10
II	**Spoilage and food preservation:** Contamination, spoilage and preservation of fruits and vegetables, meat, poultry, eggs, fish and other sea foods. Canning - Methods -Spoilage of canned foods. Food borne diseases, food intoxication and their control measures	K1-K3	12
III	**Dairy Microbiology:** Micro flora of milk. Sources of milk contamination, spoilage and Preservation of milk and milk products. Fermented foods. Dairy products- Yoghurt, curd, cheese, butter, flavoured milk. Food sanitation. Food control agencies and their regulations, FSSAI	K4	12
IV	**Environmental Microbiology**: Microbiology of air - composition of air, number and types of organisms in air. Distribution and sources of air borne organisms. Enumeration of bacteria in air - Air sampling devices. Air sanitation. Air borne diseases and their control. Microbiology of water- Indicator organisms, Assessment of water quality. Water sanitation. Water borne diseases. ISI and BIS Regulations for packaged drinking water.	K4	13
V	**Waste treatment:** Types of wastes - Characterization of solid and liquid wastes. Effluent treatment - Primary, secondary (aerobic and anaerobic) and tertiary Methods. Definition of DO, BOD, COD, TDS and their limits in treated industrial effluents. Solid waste management - Composting, vermi composting, Mushroom cultivation, SCP and Biogas production.	K4	13
Course Outcome	**CO1:** Remember the knowledge about food microorganisms and their growth factors.	K1	
	CO2: Apply the knowledge methods in identification of food spoilage and preservation.	K3	
	CO3: Analyse the knowledge about the production, spoilage and preservation of diary products.	K4	
	CO4: Analyze the microbes in environment and their roles.	K4	
	CO5:– Conclude the process of waste water treatment and disposal methods	K4	

Learning Resources

Text Books	1. Adams MR & MO Moss (2005). Food Microbiology, New Age International (P) Limited. Publishers; 1st Edition, New Delhi. 2. James M Jay (2004). Modern Food Microbiology, CBS Publishers & Distributors; 4thEdition, New Delhi. 3. Patel A H (2005). Industrial Microbiology. Published Laxmi Publications; Second edition.
Reference Books	1. Rita Narayanan B. Dhanalakshmi (2013) Food Microbiology: Basic and Applied with Laboratory - New India Publishing Agency. 2. A. Bohra P. Bohra (2011) Food Microbiology, Agrobios. 3. William Frazier and Dennis Westhoff (2008) - Food Microbiology McGraw Hill Education; 4 editions. 4. Purohit SS, AK Saluja, HN Kakrani (2004). Pharmaceutical Biotechnology, Agrobios (India); Ist Edition.

Website Link	1. https://www.in.gov/health/laboratories/environmental-microbiology/ 2. https://ajph.aphapublications.org/doi/book/10.2105/MBEF.0222			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards													
Course Code	**Course Title**				**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**	
21M3PMIC08	**FOOD, DAIRY AND ENVIRONMENTAL MICROBIOLOGY**				**DSC THEORY - VIII**		**III**	**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	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													
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, Video presentation												
Assesment Methods	Unit Test, Class Test, Assignment, Internal Examination, Model Presentation												

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

MUTHAYAMMAL COLLEGE OF ARTS & SCIENCE
RASIPURAM
637 408
Tamil Nadu

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3PMIC09	SOIL, AGRICULTURAL MICROBIOLOGY AND BIODEGRADATION	DSC THEORY - IX	III	5	5			5
Objective	To learn about the role of soil microorganisms in agricultural and biodegradation							
Unit	Course Content						Knowledge Levels	Sessions
I	**Distribution of microorganisms:** Microorganisms in soil - Autochthonous, Allochthonous and Zymogenous microbes, Enumeration of microorganisms in soil. Role of microorganisms in soil fertility. Factors influencing the soil micro flora, moisture, pH, temperature and organic matter.						K1-K2	10
II	**Biogeochemical cycles**: Carbon cycle, Nitrogen cycle - nitrogen fixation, ammonification, nitrification, denitrification process. Nitrogen fixation – symbiotic - root nodulation, non symbiotic, associative organisms, nitrogenase, hydrogenase, nif gene, nod gene. Phosphorus solubilization by phosphobacteria and potash - mobilization by mycorrhizal fungi.						K1-K2	12
III	**Interaction between soil microbes and living system**: Commensalism, Symbiosis, Synergism, Mutualism, Amensalism, Parasitism, Predation and Competition. Microbial interaction with plants - Rhizosphere concept - R: S ratio, rhizoplane; spermosphere; phyllosphere, Mycorrhizae - types. Interaction of microbes with animal- Rumen. Interaction of microbes with insects.						K1-K2	12
IV	**Phytopathology** – Classification of plant diseases, signs, and related terminology, disease cycle and control measures. Bacterial disease – Citrus canker, Blight of paddy, Fungal Disease - Red rot of sugarcane, Black stem rust of wheat, Tikka leaf spot, Wilt of cotton, Viral Disease – Tobocco disease, Vein clearing disease in Bhindi. Integrated plant disease management.						K4	14
V	**Biofertilizers** – Rhizobium, Azotobacter, Cyanobacteria, Azolla, PGPR, VAM. Organic matter decomposition and humus formation. Biopesticides – Bacillus thuringiensis, Psuedomonas fluroscence, Trichoderma viridae. Nuclear Polyheadrosis Virus. Biodegradation – Cellulose, Lignin. Biodetoriation – Wool, Leather. Bioleaching- Copper. Bioremediation – Degradation of DDT (Xenobiotic Compounds).						K3-K4	12
Course Outcome	**CO1:** Remember the knowledge about soil microbes with various environmental factors.						K1	
	CO2: Understand the knowledge about nutrients cycle, nitrogen fixation by soil microbes.						K3	
	CO3: Summarize the knowledge about soil microbial interaction with microbes, plants, animals and insects.						K2	
	CO4: Analyze the plant diseases and their control measures.						K4	
	CO5: Classify the knowledge about biofertilizers and Biodegradation and its applications						K4	
Learning Resources								
Text Books	1. Subba Rao 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. 3. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. Fourth edition, PHI Learning (P) Ltd., New Delhi.							

Reference Books	1. Rangaswami G and Bagyaraj DJ (2002). Agricultural Microbiology. Second edition, PHI Learning (P) Ltd., New Delhi. 2. Robert, L Tate (1995). Soil Microbiology. First edition, John Wiley and Sons, Inc. New York. 3. Sharma, P.D. (2001), Plant Pathology. First Edition. Rastogi Publications. 4. Atlas, R.M. and Bartha, R (1992). Microbial Ecology, Fundamental and Application, 3rd Edition, Bengamin and Cummings.
Website Link	1. https://www.kopykitab.com 2. https://www.intechopen.com 3. https://novapublishers.com 4. https://www.sciencedirect.com

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

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

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3PMIC09	SOIL, AGRICULTURAL MICROBIOLOGY AND BIODEGRADATION	DSC THEORY - IX	III	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	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, 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

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M3PMIP05	Practical: PARASITOLOGY, FOOD AND ENVIRONMENTAL MICROBIOLOGY	DSC PRACTICAL - V	III	3	-	-	3	2

Objective	To learn about the knowledge in parasites, Food and environmental Microbiology

S.No.	List of Experiments / Programmes	Knowledge Levels	Sessions
1	Examination of parasites in clinical specimens - ova/cysts in faeces Saline/iodine / LPCB / Wet mount	K2-K5	3
2	Direct and concentration: methods - Formal Ether and Zinc sulphate methods - Saturated salt solution method.	K2-K5	3
3	Blood smear examination for malarial parasites.	K2-K5	3
4	Microbiological (Bacteria and Fungi) examination of spoiled foods • Vegetables • Fruits • Dairy products	K2-K5	3
5	Examination of microbial load in • Fruit pulp • Carbonated beverages • Ice creams	K2-K5	3
6	Assessment of milk quality by • Methylene Blue Reduction Test (MBRT) • Resazurin Test	K2-K5	6
7	Quantification of microbes in air by • Settle plate method • Air sampler	K2-K5	3
8	Examination of potability of drinking water by • Membrane filter technique • Standard Plate Count (SPC) method • Most Probable Number Test (MPN)	K5	9
9	Physico- chemical assessment of treated water by • DO • COD • BOD • TDS	K1-K5	6

Course Outcome		
	CO1: Remember the morphology of parasites from stool and blood sample.	K1
	CO2: Understand the laboratory techniques for food, dairy Microbiology.	K2
	CO3: Apply the methods of enumeration of air microbes from air, water.	K3
	CO4: Analyze the quality of water using various methods.	K4
	CO5: Evaluate the physico - chemical parameters of water.	K5

Learning Resources

Text Books	1. Dubey, R.C and Maheshwari, O.K (2005) Practical Microbiology, S Chand and Co. Ltd., (First edition), New Delhi. 2. James G. Cappuccino and Natalie Sherman (2014) Microbiology: A Laboratory Manual (10th Edition), Pearson

Reference Books	1. Kannan N (2003). Handbook of laboratory culture media, Reagents, Stains and buffers. Panima Publishing Corporation, NewDelhi. 2. Cowan and Steel (1995) Manual for Identification of Medical Bacteria, 4th Edn. Cambridge University Press, London. 3. Murray, P.R., Baron, E.J., Jorgensen, J.H., Pfaller, M.A. and Yoke, R.H. (2003) Manual of Clinical Microbiology, 8th Edn. Vol 1&2, ASM Press, Washington, D.C.
Website Link	1. https://www.vnmkv.ac.in/student-academic/FMS-122.pdf 2. http://uomosul.edu.iq/public/files/datafolder_2912/_20191228_083834_930.pdf 3. https://books-library.net/files/books-library.online-01101408Pe0S5.pdf

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

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M3PMIP05	Practical: PARASITOLOGY, FOOD AND ENVIRONMENTAL MICROBIOLOGY	DSC PRACTICAL - V	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	M	M	S	S
CO2	S	M	S	S	S	S	S	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, Field visit, model preparation and Kahoot app,
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

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

07/02/22

Curriculum Development Cell
MCAS
(Autonomous)
Rasipuram

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M3PMIP06	Practical: AGRICULTURAL MICROBIOLOGY	DSC PRACTICAL - VI	III	3	-	-	3	2

Objective	To understand the basic information on bacterial and fungal industrial products. Important knowledge on microbial products. Create knowledge on industrially important process

S.No.	List of Experiments / Programmes	Knowledge Levels	Sessions
1	Enumeration of Heterotrophic microbes from soil	K1-K3	3
2	Isolation of *Rhizobium sps* from root nodules	K2-K5	3
3	Isolation of *Azotobacter sps* from soil	K3	3
4	Isolation of *Azospirillum sps* from root	K1	3
5	Isolation of Phosphate Solubilizers	K2-K3	3
6	Estimation of R:S ratio of Rhizosphere	K2-K3	3
7	Isolation and identification of plant pathogens • *Citrus canker – Xanthomonas citri* • *Blight of paddy – Xanthomonas oryzae* • *Tikka leaf spot - Cercospora sp.* • *Wilt of cotton – Fusarium oxysporum* • *Red rot of sugarcane – Colletotricum falcatum*	K4	9
8	Study of Cyanobacteria • *Anabaena* • *Nostoc* • *Oscillatoria*	K2	3
9	Isolation and identification of *Trichoderma* sp.	K1	2
10	Isolation of Cellulose degrading bacteria.	K1	3
11	Isolation of Xenobiotic (pesticide) degrading bacteria.	K1	3
12	Microscopic observation of Mycorrhizae/spore	K1	2

Course Outcome		
	CO1: Remember the various types of soil beneficial microorganisms.	K1
	CO2: Understand the differentiation of rhizosphere and non - rhizosphere soil microbes.	K2
	CO3: Apply the knowledge about the plant pathogens and study of cyanobacteria.	K3
	CO4: Analyze the biocontrol agents.	K4
	CO5: Evaluate the knowledge about the degradation of cellulose, pesticide.	K5

Learning Resources

Text Books	1. Subba Rao 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 (1995). Soil Microbiology. First edition, John Wiley and Sons, Inc. New York. 4. R, M, Atlus and Richard Bartha (2000). Microbial Ecology, Fourth edition, An imprint of Addison Wesley Longman, Inc, New York.

Website Link	1. https://coabnau.in/uploads/1609240154_p-1mannual.pdf 2. https://cevre.erciyes.edu.tr/upload/M6Z30UUmicrobiology-laboratory-manual.pdf 3. https://kau.in/document/microbiology-laboratory-manual

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

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
21M3PMIP06	Practical: AGRICULTURAL MICROBIOLOGY	DSC PRACTICAL - VI	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	S	S	S	S
CO2	S	M	S	S	S	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, Field visit, model preparation and Kahoot app,
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

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

09/02/23

Curriculum Development Cell MCAS (Autonomous) Rasipuram

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3PMIE02	ANTIMICROBIALS AND CHEMOTHERAPY	DSE - II	III	5	5			5

Objective	To understand the basic concepts of the chemotherapeutic agents and their applications		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Introduction of antimicrobial chemotherapy:** The development of chemotherapy – general characteristics of antimicrobial drugs – factors influencing the effectiveness of Antimicrobial drugs	K1-K2	10
II	**Use of chemical agents in control:** Mode of action and applications of Phenols, alcohols, halogens, heavy metals, Quartenary ammonium compounds, aldehydes. Phenol co-efficient Test.	K1-K3	12
III	**Mechanism of action of antimicrobial drugs:** Sulphonamides and sulfa drugs, Penicillins – Cephalosporins – Tetracyclines – Aminoglycoside antibiotics – Erythromycin- Chloramphenicol; Antifungal drugs (Azole drug & Nystatin) – Antiviral drugs (Anti reteroviral drugs). Anti parasitic drugs- Anti helminthic drugs, malarial drugs (protozoan drugs).	K4	13
IV	**Antimicrobial susceptibility testing:** Tube and agar dilution disc diffusion tests – assay of antibiotics. Drugs for infections - Urinary tract infections (UTI) – Respiratory tract infection and Wound infections. European and CLSI Standards	K4	12
V	**Drug resistance:** Mechanism of drug resistance – Efflux mechanism through multi drug transporters – Enzymatic inactivation (extra and intra target modification), the origin and transmission of drug resistance. Control of the spread of resistance. Alternate strategy to control (phage therapy)	K1-K2	13
Course Outcome	**CO1:** Remember the basic concepts of chemotherapeutic agents.	K1	
	CO2: Apply the knowledge about the applications of chemicals against microorganisms.	K3	
	CO3: Analyse the Characteristic features and effectiveness of various chemotherapeutic drugs	K4	
	CO4: Analyse the test for commercially available drugs for the treatment of urinary infections, respiratory tract infections, gastro intestinal infection and Mycobacterial disease.	K4	
	CO5: Conclude the ways of emergence of drug resistance and control of spread of drug resistance in the environment.	K4	

Learning Resources

Text Books	1. David Green Wood, Antimicrobial chemotherapy, 5th edition, 2007, Oxford University Press. 2. Prescott LM, JP Heavy and DA Klein, Microbiology, 10th edition, 2016, WmC- Brown Publishers.
Reference Books	1. Jawetz E, JL Melnie and EA Adelberg, Medical Microbiology, 24th Edition, 2007. Tata McGraw publishing house. 2. Robert Crushauk Vol I and II, Medical Microbiology, 1975, ELBS Chruchil Livingston. 3. Peter Davey, Mark Wilcox, William Irving and Cruy Thwaites, Antimicrobial Chemotherapy, 7th edition, 2015, Oxford University Press.
Website Link	1. https://www.kopykitab.com 2. https://www.intechopen.com 3. https://novapublishers.com 4. https://www.sciencedirect.com

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

M.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards										
Course Code	**Course Title**				**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M3PMIE02	**ANTIMICROBIALS AND CHEMOTHERAPY**				**DSE - II**	**III**	**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	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											
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, 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	

M. Sc Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M3PMBIS1	**INTERNSHIP**	**INTERNSHIP**	**III**	**-**	**-**	**-**	**-**	**2**
Objective	To give optimum exposure on the practical aspects of Microbiology industry							

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 2nd 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 / stores. 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 an organization.		
9	Internship Training Report (30 – 50 pages) should be prepared by the student and submitted in a month's 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 **3rd 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 in microbiology industry	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 industry.	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/

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

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3PMBIS1	INTERNSHIP	INTERNSHIP	III	-	-	-	-	2

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	-
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
Dr. M.SELVAN	Dr. M.SELVAN	A. h. S

Dr.M.SELVAN, M.Sc.,M.Phil.,Ph.D.,
Assistant Professor and Head
Department of Microbiology
Muthayammal College of Arts & Science
Rasipuram-637 408. Namakkal (Dt.)
Tamilnadu.

Curriculum Development Cell
MCAS Autonomous Rasipuram

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M4PMIC10	**Research Methodology and Biostatistics**	**DSC THEORY - X**	**IV**	**5**	**5**	**-**	**-**	**5**
Objective	To learn about the data collection and methods in Research							
Unit	**Course Content**						**Knowledge Levels**	**Sessions**
I	**Research Methodology** - Meaning and importance. Statement, Constraints, Review of literature - Review and synopsis presentation. Types of research, Research tools, Qualities of a good researcher. Research process, Research designs – Experimental and non-experimental. Preparation of research report. Guidelines for preparing an article. Computers in biological research.						K1-K2	10
II	**Data collection**, source of data, types of classification of data, Tabulation of data – Diagrammatic representation of data (line, bar diagram, pie diagram, pictogram and cartogram) - Graphical representation of data. Measures of central tendency – mean, median, mode - Standard deviation. Correlation – coefficient of correlation (Karl Pearson method, group bi –variable data). Coefficient of variation. Probability.						K1-K3	15
III	ANOVA (one way and two way), Chi square test – Student's T test – testing of hypothesis-null hypothesis- level of significance-standard error. F Test Web Resources for Microbiology – Use of Digital Library.						K2	13
IV	**Bioinformatics** - Introduction and skills for a bioinformatician. Biological databases- Database searching, Sequence analysis, Pair alignment, Visualizing protein structures, Predicting structure and function of proteins using sequences, Tools for genomics and proteomics.						K2	12
V	**Bioinstrumentation** - Principles and applications of pH meter, Centrifuge. Electrophorosis. Chromatography - Thin layer, Column, Gas and high pressure liquid chromatography, Spectrophotometry, NMR, Atomic absorption spectrophotometer, Microbial Identification System, Autoanalyser - ELISA Reader.						K1-K3	10
Course Outcome	**CO1:** Remember the knowledge about basic concept of Research Methodology						K1	

	CO2: Understand the knowledge about Data collection	K2	
	CO3: Experiment the details in Biostatistics and interpret results of descriptive statistical methods.	K3	
	CO4: Compare the knowledge about basic concept Bioinformatics	K4	
	CO5: Summarize the methodology of the instruments and its applications	K5	

Learning Resources	
Text Books	1. Balagurusamy. E, 1992, Programming in ANSIC, Tata Mcgraw Hill. 2. Bernard Rosner, 1999, Fundamentals of Biostatistics, Duxbury Press. 3. Attwood T.K. and D.J. Parry-Smith, 2001. Introduction to Bioinformatics, Pearson Education Asia. 4. Jeffrey A. Witmer Myra L. Samuels, 2002. Prentice Hall Statistics for the Life Sciences (3rd Edition).
Reference Books	1. Gurumani. N., 2006. Research methodology for biological sciences. 1st edition, MJP Publishers. A unit of Tamil Nadu Book House, Chennai. 2. Wayne W. Daniel, 2006. Biostatistics- A foundation for analysis in the Health Sciences. 7TH edition. Wiley India publication. 3. Rastogi. S. C, N. Mendiratta and P. Rastogi, 2008. Bioinformatics- Methods and Applications Genomics, Proteomics and Drug Discovery 3rd edition. 4. Harvey Motulsky, 1995, Intuitive Biostatistics, Oxford University Press.
Website Link	1. https://nptel.ac.in/courses/102101056/ 2. https://nptel.ac.in/courses/102101067/

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

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code	**Course Title**				**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M4PMIC10	**Research Methodology and Biostatistics**				**DSC THEORY - X**		**IV**	**5**	**5**	**-**	**-**	**4**
CO-PO Mapping										
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**		
CO1	S	S	S	S	S	M	M	M	M	M		
CO2	S	S	S	S	S	M	M	M	M	M		
CO3	S	S	S	S	S	M	M	M	M	M		
CO4	S	S	S	S	S	M	M	M	M	M		
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, Video presentation											
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE											

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

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M4PMIC11	**PRINCIPLES OF ECOLOGY**	**DSC THEORY - XI**	**IV**	**5**	**5**	**-**	**-**	**4**
Objective	To learn about the Environmental pollution and Ecological methods							
Unit	**Course Content**					**Knowledge Levels**		**Sessions**
I	**Basic Concepts**: Definition, scope and significance of Ecology; Concept of biosphere, atmosphere, lithosphere and hydrosphere; components of atmosphere; concept of habitat and ecological niche. Factors affecting environment: Abiotic factors, edaphic factors, biotic factors.					K1-K2		10
II	**Ecological energetic and energy flow**–food chain, food web, tropic structure. Concept of productivity: primary, secondary, gross and net. Biogeochemical cycles: Concept, reservoir pool, exchangeable pool, hydrological cycle, gaseous cycles and sedimentary cycles, effect of pollution on biogeochemical cycles.					K1-K2		15
III	**Biomes**: Concept, Major biomes of the world: forest, desert and grasslands of India. Development and evolution of ecosystem: Succession – definition, causes and types (hydrosphere, lithosphere): primary and secondary succession					K2		13
IV	**Community ecology**: Concept of community and its characteristics; concept of ecological dominance, species composition. Species diversity in communities. Weed ecology: Concept, impact of weeds in agro ecosystem, forest, grassland and urban ecosystems					K2		12
V	**Environmental pollution**. Scope, sources of air, water and soil pollution. Plant Indicators of Pollution: Bioindicators, Biomonitoring, Bioremediation, Biofilm and Biocorrosion. Radiation and noise pollution-effects and control measures. Environmental management and legislation. Environmental education- Principles, Environmental education programmes. Environmental education in India. Environmental organization and agencies.					K2		10
Course	**CO1:** Remember the knowledge about the concepts in Ecology					K1		

Outcome	**CO2:** Understand the knowledge about role of biological systems in life		K2	
	CO3: Experiment the structural components of different biotic systems		K3	
	CO4: Compare the knowledge about evolution, ecology, plants, animals and inheritance		K4	
	CO5: Assess the process Environmental pollution		K5	
Learning Resources				
Text Books	1. Peter J. Stoett (2 September 2003).International Relations Theory and Ecological Thought: Towards a Synthesis. Routledge. pp. 25 2. Stadler, B.; Michalzik, B.; Müller, T. (1998). "Linking aphid ecology with nutrient fluxes in a coniferous forest".Ecology 79 (5): 1514–1525.			
Reference Books	1. Humphreys, N. J.; Douglas, A. E. (1997). "Partitioning of symbiotic bacteria between generations of an insect: a quantitative study of a Buchnera sp. in the pea aphid (Acyrthosiphonpisum) reared at different temperatures". Applied and Environmental Microbiology 63 (8): 3294–3296. 2. Odum, E. P.; Barrett, G. W. (2005).Fundamentals of Ecology. Brooks Cole. p. 598. 5. Nachtomy, Ohad; Shavit, Ayelet; Smith, Justin (2002). "Leibnizian organism			
Website Link	1.https://nptel.ac.in/courses/102104068 2.https://nptel.ac.in/courses/102104073 3.https://nptel.ac.in/courses/102107086/			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M4PMIC11	**PRINCIPLES OF ECOLOGY**			**DSC THEORY - XI**		**IV**	**5**	**5**	**-**	**-**	**4**
CO-PO Mapping										
CO Number	**P01**	**P02**	**P03**	**P04**	**P05**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	S	S	S	S	S	M	M	S	M	S	
CO2	S	S	S	S	S	M	M	S	S	S	
CO3	S	S	S	S	S	M	M	S	S	S	
CO4	S	S	S	S	S	M	M	S	S	S	
CO5	S	S	S	S	S	M	M	S	S	S	
Level of Correlation between CO and PO	L-LOW				M-MEDIUM		S - STRONG				
Tutorial Schedule	Group Discussion, Field visit, Quiz program, model preparation and Kahoot app										
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, Video presentation										
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE										

Designed By	**Verified By**	**Approved By**
Dr.M.Selvan	Dr.M.Selvan	A-h-5

Curriculum Development Cell MCAS Autonomous Rasipuram

M.Sc., Microbiology for Competitive Examination Syllabus-LOCF-CBCS-Pattern with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**CourseType**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M4PMIOE1	Microbiology for Competitive Examination	**Self study** Online -Competitive Examination	IV	-	-	-	-	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**	**Sessions**
	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 such as ICAR-JRF/SRF/NET/ARS, IARI/NDRI Ph.D., SAUs; CSIR/UGC-NET/JRF/SRF; ICMR, DBT, GATE, BARC, II Sc, JNU, BHU, etc. to get admission in Ph.D., Microbiology. 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 4th semester. 2. Questions must be taken from all previous question papers of CSIR-NET, SET, NEET, UPSC, IBPS and Common Entrance Test for Ph.D. 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	NET/SET/GATE/CET/TRB /NEET 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**
Dr.S.Anbalagan	Dr.M.Selvan	

Curriculum Development Cell MCAS Autonomous Rasipuram

M.Sc., Microbiology LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M4PMBPR1	**PROJECT WORK**	**PROJECT WORK**	**IV**	**12**	**-**	**-**	**17**	**5**
Objective	To inculcate/impart skills on experiment designing, experiment execution and research report to provide skills on writing thesis 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		
	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, i.e, 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 i.e, 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 italic.	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 research idea	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 C.R. Kothari, New Age Publications, 2009.
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/

M.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
21M4PMBPR1	PROJECT WORK	PROJECT WORK	IV	12	-	-	17	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	-
Assessment Methods	**EA - 100%** 1. Project Report - 150 Marks 2. Viva-Voce - 50 Marks 3. Total - 200 Marks

Designed By	Verified By	Approved By
Dr. M.SELVAN	Dr. M.SELVAN	

Dr.M.SELVAN, M.Sc., M.Phil., Ph.D.,
Assistant Professor and Head
Department of Microbiology
Thayammal College of Arts & Science
Rasipuram-637 408. Namakkal (Dt.)
Tamilnadu.

Curriculum Development Cell
MCAS (Autonomous)
Rasipuram

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIED1	**INFECTIOUS DISEASES AND DIAGNOSTICS**	**EDC**	**II**	**5**	**5**	**-**	**-**	**4**
Objective	To understand the medically important bacteria, fungi, virus parasites and its diagnosis							

Unit	Course Content	Knowledge Levels	Sessions
I	Scope and relevance of Microbiology - Definition and concepts, Type of microorganism, Distribution of Microorganism in nature; Development of Microbiology as a Scientific discipline; General characteristics of microorganisms - General principles, Taxonomy, classification and structural organization of Bacteria, Fungi, Viruses, Algae, *Actinomycetes, Mycoplasma*, and *Ricketssiae;* Microscopy-Principles and applications.	K1-K2	12
II	Fixatives and Fixation of smears, Stains - Definition, Acidic, Basic stains, simple and differential staining, use and significance of stains in microbiology; cultivation of microorganism- Pure culture techniques; cultivation of anaerobes; control of microorganism-sterilization by physical and chemical methods, Antiseptics	K2-K3	12
III	Binomial nomenclature; Outline classification of living organisms-Haeckel, Whittaker, and woese system, normal micro flora in human body and their beneficial effects; Lymphoid organs and types of immunity; General principles of diagnostic microbiology - collection, transport, and processing of clinical specimens, General methods of laboratory diagnosis-cultural, biochemical, serological, and molecular methods.	K3	12
IV	Host pathogen interaction- virulence factors, General account of the following diseases - Causal organisms, pathogenesis, diagnosis, prevention and therapy of Typhoid, cholera, dysentery, whooping cough, tuberculosis, Malaria, small pox, and AIDS. General account of Nosocomial Infections and prevention.	K3- K4	12
V	Antimicrobial therapy in the diagnosis of diseases; In vitro diagnostic methods- agglutination, precipitation, immunofluoresence, ELISA, Skin test; Vaccines: Principles underlying the preparation of live and attenuated vaccines. Immunization; Automation in Disease diagnosis.	K4	12
Course	**CO1:** Remember the knowledge about infectious agents.	K1	

Outcome	**CO2:** Understand the knowledge about identification of infectious agents.	K2	
	CO3: Illustrate the knowledge about classification and diagnosis of infectious agents.	K3	
	CO4: Summarize the Pathogenesis of medically important bacteria and virus.	K4	
	CO5: Summarize the knowledge about diagnosis and preventive measures	K4	

Text Books	1. Morag, C. and Timbury, M.C. (1994) Medical Virology, 10th Edn. Churchill Livingston, London. 2. Dimmock, N.J. and Pimrose, S.B. (1994) Introduction to Modern Virology, 4th Edn. Blackwell Scientific Publications, Oxford.
Reference Books	1. Conrat, H.F., Kimball, P.C. and Levy, J.A. (1994) Virology, 3rd Edn, Prentice Hall, New Jersey. 2. Maloy SR,Cronan Jr.JE, Freifelder D. (1998). Microbial Genetics. Jones and Bartlett publishers. 3. Robert G. Welstar and Allan Garnoll. Encyclopaedia of Virology (1994). Vol. I, II &III Academic Press inc. San Diego, CA 92101. Ed.
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

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards													
Course Code	**Course Title**				**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
21M2PMIED1	INFECTIOUS DISEASES AND DIAGNOSTICS				EDC		II	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	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, Video presentation												
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE												
Designed By	**Verified By**									**Approved By**			
Dr.S.Anbalagan	Dr.M.Selvan									A. Anbalagan			

Curriculum Development Cell MCAS Autonomous Rasipuram

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIED2	**ENTREPRENEURIAL MICROBIOLOGY**	**EDC**	**II**	**5**	**5**	**-**	**-**	**4**
Objective	To learn about the self employability							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	Entrepreneur development, activity, Institutes involved, Government contributions to entrepreneur, risk assessment, Industrial Microbiology, Definition, scope and historical development.	K1-K2	12
II	Microbial cells as fermentation products – Baker's yeast, food and feed yeasts, bacterial insecticides, legume inoculants, Mushrooms, Algae, Enzymes as fermentation products-bacterial and fungal amylases, proteolytic enzymes	K1-K2	12
III	Mushroom cultivation and composting-cultivation *of Agaricus campestris, Agaricus bisporous and Volvoriell volvaciae:* Preparation of compost, filling tray beds, spawning, maintaining optimal temperature, casing, water harvesting, storage, Biofertilizer-Historical background, chemical fertilizers versus biofertilizers, organic farming. *Rhizobium sp., Azospirillum sp., Azotobacter sp., as Biofertilizers.*	K3	12
IV	Brewing - Media components, preparation of medium, microorganisms involved, maturation, carbonation, packaging, keeping quality, contamination, by products. Production of industrial alcohol.	K4	12
V	Patents 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. Fermentation economics.	K4	12
Course Outcome	**CO1:** Remember the knowledge about scope of the Entrepreneurial microbiology.	K1	
	CO2: Understand the knowledge about fermentation products.	K2	
	CO3: Illustrate the knowledge about production methods.	K3	
	CO4: Interpret the knowledge about industrial processing	K4	
	CO5: Interpret the knowledge about Patents and copy writing.	K4	

Learning Resources	
Text Books	1. Prescott LM, Harley JP and Klein DA (2003) Microbiology (10th edition) McGraw Hill, New York. 2. Pelczar Jr, M.J. Chan, E.C.S and Krei N.R (1993) Microbiology McGraw Hill, New York.

Reference Books	1. Subba Rao NS (1997). Biofertilizer in Agriculture and Forestry, 3rd edition, Oxford & IBU Publications. 2. LE Cassida JR (2005). Industrial Microbiology. New Age International (P) Ltd., New Delhi. 3. Arora. Entrepreneurial Development in India. 4. Aneja, K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, 6th Edition, New age International Publication.			
Website Link	1. https://www.learncbse.in/cbse-notes-class-11-entrepreneurship/ 2.https://byjus.com/commerce/entrepreneurship-development-process/			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2021-2022 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
21M2PMIED2	ENTREPRENEURIAL MICROBIOLOGY		EDC		II	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	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, Field visit, model preparation and Kahoot app,									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation, Video presentation									
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE									
Designed By	**Verified By**							**Approved By**		
Mr.N.Radhakrishnan	Dr.M.Selvan									

Curriculum Development Cell MCAS Autonomous Rasipuram