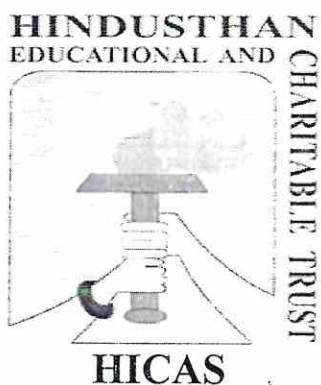


**CURRICULUM FRAMEWORK AND SYLLABUS
FOR OUTCOME BASED EDUCATION IN**

BACHELOR OF SCIENCE IN MICROBIOLOGY DEGREE PROGRAM

**FOR THE STUDENTS ADMITTED FROM THE
ACADEMIC YEAR 2019 - 2020 AND ONWARDS**



HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

(Affiliated to Bharathiar University and Accredited by NAAC)

COIMBATORE-641028

TAMILNADU, INDIA.

Phone: 0422-4440555

Website: www.hindusthan.net/hicas/

**HINDUSTHAN COLLEGE OF ARTS AND SCIENCE
DEPARTMENT OF MICROBIOLOGY**

VISION

To provide world class education to the students to face global challenges and to inculcate the latest trends in technological advancement. To cater the needs of the environmental and ethical values in the mind of students to become good citizens and entrepreneurs.

MISSION

The Mission of the college is to pursue a philosophy of perpetual acquisition of knowledge. The important policy is to provide value based education and to bring out the hidden potentials in students that equip them to approach life with optimism.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

Under Graduates of MICROBIOLOGY program will

PEO1: Understand the impact of science in societal and environmental contexts, and demonstrate the need for sustainable development

PEO2: Create, select and apply appropriate techniques and scientific resources with a professional understanding of the limitations

PROGRAM OUTCOME (PO)

- PO1:** Acquire, articulate, retain and apply specialized language and knowledge relevant to Microbiology.
- PO2:** Design and carry out experiments safely and to interpret experimental data
- PO3:** Prepare them for careers in the industry, agriculture, and applied research where biological system is increasingly employed.
- PO4:** Apply ethical principles and commit to professional ethics, communicate effectively and recognize the need for life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOME (PSO)

- PSO1:** To prepare students as skilled scientific manpower with an understanding of Research ethics (public policy, biosafety, and intellectual property rights) involving microorganisms to contribute to application, advancement and impartment of knowledge in the field of Microbiology.
- PSO2:** Production of substantial original research of significance and quality sufficient for publication.
- PSO3:** Ability to present their work through written, oral, and visual presentations, including an original research proposal

HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

COIMBATORE-641028

B.Sc., MICROBIOLOGY

SCHEME OF EXAMINATIONS – CBCS PATTERN

(For the students admitted from the Academic year 2019-2020 and onwards)

Course Code	Course Type	Course Title	LECTURE HRS/WEEK	EXAM DURATION HOURS	MAXIMUM MARKS			Credit points
					IE	EE	Total	
Semester – I								
Part – I								
19LAT01 19LAH01 19LAM01 19LAF01	MIL	Tamil –I Hindi –I Malayalam – I French – I	6	3	30	70	100	3
Part – II								
19ENG01	AECC	English – I	6	3	30	70	100	3
Part – III								
19MBU01	DSC	Basic concepts of Microbiology	6	3	30	70	100	6
19MBU02	SEC	Practical I – Basic concepts of Microbiology	5	3	40	60	100	3
19MBU03	GE	Allied Chemistry	5	3	30	70	100	4
19MBU04	GE	Allied Practical I – Chemistry	2	3	40	60	100	1
Semester – II								
Part – I								
19LAT02 19LAH02 19LAM02 19LAF02	MIL	Tamil – II Hindi – II Malayalam – II French – II	6	3	30	70	100	3
Part – II								
19ENG02	AECC	English – II	6	3	30	70	100	3
Part – III								
19MBU05	DSC	Microbial Physiology and Metabolism	5	3	30	70	100	5
19MBU06	SEC	Practical II - Microbial Physiology and Metabolism	5	9	40	60	100	3
19MBU07	GE	Allied - Biomolecules (MIC)	4	3	30	70	100	3
19MBU08	GE	Allied Practical II - Biomolecules (MIC)	2	3	40	60	100	1
Part – IV								
19GSU01	AEE	Value Education - Human Rights	2	-	100	-	100	2
Students Should Complete Value Added Courses, Communicative English And Soft Skills at the End of the First Year								

Semester – III								
Part – I								
19LAT03 19LAH03 19LAM03 19LAF03	MIL	Tamil – III Hindi - III Malayalam – III French – III	5	3	30	70	100	3
Part-II								
19ENG03	AECC	English – III	5	3	30	70	100	3
Part-III								
19MBU09	DSC	Microbial Taxonomy and Diversity	4	3	30	70	100	4
19MBU10	DSC	Microbial Genetics	4	3	30	70	100	4
19MBU11	SEC	Practical III – Microbial diversity and Genetics	4	9	40	60	100	2
19MBU12	GE	Allied - Biochemistry (MIC)	4	3	30	70	100	3
19MBU13	GE	Allied Practical III - Biochemistry (MIC)	2	3	40	60	100	1
Part – IV								
19GSU02	AEE	Environmental Studies	2	-	100	-	100	2
Semester – IV								
Part – I								
19LAT04 19LAH04/ 19LAM04 /19LAF04	MIL	Tamil-IV Hindi-IV Malayalam -IV French-IV	5	3	30	70	100	3
Part – II								
19ENG04	AECC	English – IV	5	3	30	70	100	3
Part-III								
19MBU14	DSC	Immunology	4	3	30	70	100	4
19MBU15	DSCI	Medical Bacteriology	4	3	30	70	100	4
19MBU16	SEC	Practical IV – Medical Bacteriology and Immunology	4	9	40	60	100	2
19MBU17	GE	Allied - Biostatistics and Computers (MAT)	4	3	30	70	100	3
19MBU18	GE	Allied Practical IV - Biostatistics and Computers (MAT)	2	3	40	60	100	1
Part – IV								
19GSU03	AEE	Internet Security	2	-	100	-	100	2
Part – V								
19GSU04	AECC	Extension Activity		-	100	-	100	G
Students Should Complete Value Added Courses, Online Courses (Or) Participation Certificates For Seminars, Workshops From Other Institutions For Each Semester And Womens Studies / Interdisciplinary at the end of Second Year								
Extension Activity – means all those activities under NSS/NCC/sports/YRC Programme and other Co and extra curricular activities offered under part V of the programme. Every student shall participate compulsorily for a period of not less than two years (4 semesters) in any one of these programmes.								

Semester – V								
Part – III								
19MBU19	DSC	Genetic Engineering	5	3	30	70	100	5
19MBU20	DSC	Environmental and Agricultural Microbiology	5	3	30	70	100	5
19MBU21	DSC	Food and Industrial Microbiology	5	3	30	70	100	5
19MBU22 A	DSE	Textile Microbiology	5	3	30	70	100	5
19MBU22 B		Pharmaceutical Microbiology						
19MBU22 C		Waste Management						
19MBU23	SEC	Practical V- Genetic Engineering and Environmental Microbiology	4	9	40	60	100	2
19MBU24	SEC	Practical VI – Food and Industrial Microbiology	4	9	40	60	100	2
19MBU25	DSE	Mini Project	2	-	100	-	100	2
Part – V								
19GSU05	AEE	General Awareness	-	-	100	-	100	2
19GSU06	AECC	Law of Ethics	-	-	100	-	100	2
Semester – VI								
Part – III								
19MBU26	DSC	Virology	5	3	30	70	100	5
19MBU27	DSC	Medical Mycology and Parasitology	5	3	30	70	100	5
19MBU28	DSC	Bioinformatics and Nanotechnology	5	3	30	70	100	5
19MBU29 A	DSE	Entrepreneurship in Microbiology	5	3	30	70	100	5
19MBU29 B		Large Scale Manufacturing Practices						
19MBU29 C		Bioethics, IPR and Biosafety						
19MBU30	SEC	Practical VII- Virology, Mycology and Parasitology	5	9	40	60	100	3
19MBU31	SEC	Practical VIII- Bioinformatics and Nanotechnology	5	3	40	60	100	3
Total								140
Students Should Complete Value Added Courses, Online Courses / Entrepreneurship/Startups/ Job Oriented Courses and Placement Training at the end of the Third Year								

No of papers	Course Type	Total Credit Points
4	Modern Indian Language(MIL)	12
6	Ability Enhancement Compulsory course (AECC)	16
4	Ability Enhancement Elective (AEE)	8
12	Discipline Specific course(DSC)	57
3	Discipline Specific Elective(DSE)	12
8	Skill Enhancement Course(SEC)	20
8	Generic Elective (GE)	17
45	TOTAL	142

UG- REGULATION (2019-2020 and Onwards)

1. Internal Marks for all UG

Components	Marks
Test I	5
Test II	5
Model Exam	10
Assignment	5
Attendance*	5
TOTAL	30

*Split-up of Attendance Marks for UG

- 75-79 - 1 marks
- 80-84 - 2 marks
- 85-89 - 3 marks
- 90-94 - 4 marks
- 95-100 - 5 marks

**3-For External paper presentation/ Mini Project

**2-Internal paper presentation/ Mini Project

QUESTION PAPER PATTERN FOR IE TEST I AND II

Duration: Two Hours

Maximum: 50 Marks

SECTION - A (6 x 1 = 6 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

Multiple choice/Fill up the blanks /True or False questions

SECTION - B (4x 5 = 20 marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

Either or Type

SECTION - C (3x 8 = 24 marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

Either or Type

QUESTION PAPER PATTERN FOR IE MODEL EXAMINATION

Duration: Three Hours

Maximum: 70 Marks

SECTION - A (10x1=10 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

Q.No 1 to 10: (Multiple choice/Fill up the blanks /True or False questions).
(Two questions from each unit)

SECTION - B (5x4=20 Marks)

Answer **ALL** Question

ALL Questions Carry **EQUAL** Marks

Q.No 11 to 15: Either or type questions (One question from each Unit)

SECTION- C (5x8=40 Marks)

Answer **ALL** Questions

ALL Questions carry **EQUAL** Marks

Q.No 16 to 20: Either or type questions (One question from each Unit)

2 a) Components for Practical I.E.

Components	Marks
Test -I	20
Test - II	20
Total	----- 40 =====

2 b) Components for Practical E.E.

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
Total	----- 60 =====

3. Institutional/ Industrial Training, Mini Project and Major Project Work

<u>Institutional /Industrial Training</u>		<u>Mini Project</u>	<u>Major Project Work</u>	
Components	Marks	Marks	Components	Marks
I.E Work Diary	25	-	I. E a) Attendance 10 Marks	40
Report	50	50	b) Review / Work Diary* ¹ 30 Marks	
Viva –voce Examination	25	50		
Total	<u>100</u>	<u>100</u>	E.E* ² a) Final Report 40 Marks	60
			b) Viva-voce 20 Marks	
			Total	<u>100</u>

*¹ Review is for Individual Project and Work Diary is for Group Projects (group consisting of minimum 3 and maximum 5)

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

4. Components for Value Education (Part IV):

S.No.	Components	Marks
a)	Attendance 96% and above - 30 marks 91% to 95% - 25 marks 86% to 90% - 20 marks 76% to 85% - 10 marks	30 marks
b)	Participation in group activity	30 marks
c)	Assignment (2 x 10)	20 marks
d)	Test (1 hr for 20 marks) 2 out of three questions, 10 marks each	20 marks
	Total	100 marks

On completion of the above components students will be remarked as follows:

Range of marks	Equivalent remarks
80 and above	Exemplary
70 – 79	Very good
60 – 69	Good
50 – 59	Fair
40 – 49	Satisfactory
Below 39	Not Satisfactory = Not completed

The passing minimum for this paper is 40%

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

5. Guidelines for Environmental Studies (Part IV)

The paper Environmental Studies is to be treated as 100% IE course which is offered in III Semester for II year UG students. The classes will be handled for two hours per week till the end of the Semester. At least one field trip should be arranged.
Total Marks for the subject = 100

Components	Marks
Two Tests (2 x 30)	60
Field visit and report (10 + 10)	20
Two assignments (2 x 10)	20
Total	----- 100 =====

The question paper pattern is as follows:

Test I – 2 hours [3 out of 5 essay type questions] 3 x 10 = 30 Marks
Test II – 2 hours [3 out of 5 essay type questions] 3 x 10 = 30 Marks

Total 60 Marks

The passing minimum for this paper is 40%

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

6. Guidelines for Skill based subject - Internet Security (Part IV)

Components	Marks
Two Tests (2 x 40)	80
Two assignments (2 x 10)	20
Total	----- 100 =====

The question paper pattern is as follows:

Test I – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40Marks
Test II – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40 Marks

Total 80 Marks

The passing minimum for this paper is 40%

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

7. Guidelines for General Awareness (Part IV)

Components	Marks
Two Tests (2 x 50)	100

The question paper pattern is as follows:

Test I – 2 hours [50 multiple choice questions] 50 x 1 = 50 Marks

Test II – 2 hours [50 multiple choice questions] 50 x 1 = 50 Marks

Total 100 Marks

The passing minimum for this paper is 40%

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

8. Guidelines for Law of Ethics (Part V)

Components	Marks
Two Tests (2 x 50)	100

The question paper pattern is as follows:

Test I – 2 hours [5 out of 8 essay type questions] 5 x 10 = 50 Marks

Test II – 2 hours [5 out of 8 essay type questions] 5 x 10 = 50 Marks

Total 100 Marks

The passing minimum for this paper is 40%

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

9. Guidelines for Extension Activity (Part V)

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

The marks may be awarded as follows

No of Activities	Marks
2 x 50 (Each Activity for two days)	100

10. QUESTION PAPER PATTERN FOR EE (Part III Theory Papers)

Duration: Three Hours

Maximum: 70 Marks

SECTION - A (10x1=10 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

Q.No 1 to 10: (Multiple choice/Fill up the blanks /True or False questions).
(Two questions from each unit)

SECTION - B (5x4=20 Marks)

Answer ALL Question

ALL Questions Carry EQUAL Marks

Q.No 11 to 15: Either or type questions (One question from each Unit)

SECTION- C (5x8=40 Marks)

Answer ALL Questions

ALL Questions carry EQUAL Marks

Q.No 16 to 20: Either or type questions (One question from each Unit)

BACHELOR OF SCIENCE IN MICROBIOLOGY

Programme Code:	MBU	Programme Title: Bachelor of Science in Microbiology		
Course Code:	19MBU01	Course Title	Batch:	2019-2022
		Basic concepts of Microbiology		I
Hrs/Week:	6		Credits:	6

Course Objectives

1. To discuss about the basics and fundamentals of Microbial world.
2. To impart knowledge on the methods to observe, cultivate and preserve microorganisms.

Course Outcomes (CO)

K1	CO1	Describe the contributions of Scientists and fundamental concepts of Microbiology.
K2	CO2	Deduce the types of Microscopes and microscopic observation of microorganisms.
K3	CO3	Compare the core principles of sterilization and the different methods of sterilization.
K4	CO4	Illustrate the pure culture techniques and preservation of cultures

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	L	L	L
CO2	S	S	M	L
CO3	S	S	M	L
CO4	S	S	M	L

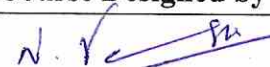
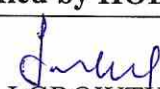

S - Strong; M-Medium; L-Low.

19MBU01	BASIC CONCEPTS OF MICROBIOLOGY	I
Unit No.	Topics	Hours
I	History and Scope of Microbiology Spontaneous generation theory and conflict - Contributions of Antony Von Leeuwenhoek - Joseph Lister - Louis Pasteur - Robert Koch - Edward Jenner-Elie Metchnikoff - Martinus Beijerinck - Alexander Fleming - Selman Abraham Waksman - John Tyndall - Scope of Microbiology. Microbiological Institutes in India.	14
II	Bacterial Cell structure and Function Shapes of Bacteria - Subcellular structures of microbes- slime layer - capsule, cell wall- Gram positive and Gram negative, cytoplasmic membrane – fimbriae - pili- flagella - storage granules- comparison of prokaryotic and eukaryotic organisms- sporulation and germination- cell division in bacteria - binary fission.	14
III	Microscopy, Stains and Staining Techniques Working principle and applications of light microscopes- Bright field, Dark field, Phase contrast, Fluorescence, confocal scanning microscope-Electron microscope- SEM and TEM. Definition of auxochrome, chromophores, dyes, Staining methods- Simple and Differential (Gram and Acid fast), Negative, Capsule, Flagellar, Endospore and fungal staining.	15
IV	Sterilization and Disinfection Principles, methods of sterilization: Physical methods: Dry heat (Hot air oven), Moist heat (Auto clave) – Sterilization control. Filtration (Membrane & HEPA) - Biosafety cabinets and Radiation (UV). Chemical sterilization: Chemical agents and mode of action: Phenol Coefficient test-Fumigation.	15
V	Culture techniques, Maintenance and Preservation of cultures Media preparations: Solid and liquid. Types of media: Synthetic and semi synthetic enriched, enrichment, selective, differential. Anaerobic culture technique: Wright's tube, Roll tube, McIntosh fields jar method. Pure culture technique: Serial dilution, pour, spread, streak plate methods. Culture preservation- Mineral oil method and Lyophilization- Lyophilizer. Culture collection centers.	14

Text Book: Prescott, Hareley.P and Klein.A., "Microbiology", McGraw Hill Publishers, New Delhi.2017

Reference Books

1. Michael J Pelczar.Jr., "Microbiology", McGraw Hill Publishers, New Delhi.2001
2. R.C Dubey., "Textbook of Microbiology", S. Chand and Company Ltd, New Delhi. 2013
3. Geeta Sumbali and Mehrotra R.S., "Principles of Microbiology", Tata McGraw Hill Publishers.New Delhi. 2009.
4. Gerard J. Tortora and Berdell R. Funke Christine L. Case., "Microbiology, An Introduction", Calif Benjamin/Cummings Pub. Co., SanFrancisco. 2015
5. Jacquelyn G. Black, Laura J. Black., "Microbiology: Principles and Explorations", Wileys Publishers, New Jersey.2012

Course Designed by	Verified by HOD	Checked by	Approved by
 DR.N.VANITHA	 DR.LALI GROWTHER		

BACHELOR OF SCIENCE IN MICROBIOLOGY

Programme Code:	MBU	Programme Title: Bachelor of Science in Microbiology		
Course Code:	19MBU02	Course Title	Batch:	2019-2022
		PRACTICAL I – BASIC CONCEPTS OF MICROBIOLOGY		I
Hrs/Week:	5		Credits:	3

Course Objectives

1. To impart practical knowledge on the tools used in Microbiology.
2. To observe and develop basic skills in aseptic techniques, observation and cultivation of microorganisms.

Course Outcomes (CO)

K1	CO1	Identify and understand various accessories for Microbiology practicals
K2	CO2	Categorize microbial growth in different media
K3	CO3	Experiment various staining techniques
K4	CO4	Cultivate and preserve bacteria

Mapping of Outcomes

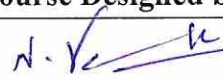
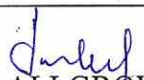

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	M	L	L
CO2	S	M	L	L
CO3	S	M	L	L
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

19MBU02	PRACTICAL I BASIC CONCEPTS OF MICROBIOLOGY	I
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LIST OF EXPERIMENTS

1. Laboratory Safety and precautions.
2. Cleaning of Glassware.
3. Operation and maintenance of Microscope.
4. Culture media preparation and colony characteristics in agar medium.
5. Selective and differential media: a) EMB agar b) Mannitol salt agar c) Mac conkey agar d) SS agar.
6. Pure culture techniques – Serial dilution, Pour plate, Spread plate and Streak Plate methods.
7. Enumeration of bacteria, fungi and actinomycetes from soil.
8. Determination of Motility – Hanging drop method, agar deep and swarming motility assay.
9. Staining of Bacteria and fungi
 - a. Simple staining
 - b. Gram staining
 - c. Negative staining
 - d. Acid fast staining (demo)
 - e. Endospore staining
 - f. Fungal wet mount - KOH
 - g. Fungal staining – Lacto Phenol Cotton Blue
10. Micrometry- determination of size of bacteria.
11. Cultivation of anaerobes- Wrights tube method, Mc'Intosh fildes jar
12. Assessment of sterility of Hot air oven and Autoclave
13. Bacterial culture preservation techniques – Paraffin method (Mineral oil), Saline suspension method and Silica gel.

Course Designed by	Verified by HOD	Checked by	Approved by
 DR.N.VANITHA	 DR.LALI GROWTHER		

BACHELOR OF SCIENCE IN MICROBIOLOGY

Programme Code:	MBU	Programme Title: Bachelor of Science in Microbiology		
Course Code:	19MBU03	Course Title	Batch:	2019-2022.
		Allied Chemistry		I
Hrs/Week:	5		Credits:	4

Course Objectives

1. To demonstrate the chemical bonding, covalent bonds and industrial chemistry.
2. To discuss about the conductance and solution types.

Course Outcomes (CO)

K1	CO1	Describe the chemical bonding structure
K2	CO2	Illustrate the geometric and isomeric properties of molecules
K3	CO3	Compare the laws of conductance and buffer solutions
K4	CO4	Classify solutions chemically

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	L	S	M	L
CO2	M	S	M	L
CO3	S	S	M	L
CO4	M	S	M	L

S - Strong; M-Medium; L-Low.

19MBU03	ALLIED I- CHEMISTRY	I
Unit No.	Topics	Hours
I	Chemical Bonding Molecular orbital theory, bonding, antibonding and non-bonding orbitals. Molecular orbitals. MO configuration of H ₂ , N ₂ , O ₂ , F ₂ . Bond order. Diamagnetism and paramagnetism. Preparation and properties, structure, preparation and uses of Borane-NaBH ₄ , Borazole- Chemistry.	12
II	Industrial Chemistry Synthesis, properties and uses of silicones. Fuel gases: natural gas, water gas, semi water gas, carburetted water gas, producer gas, oil gas (manufacturing details not required). Dye Chemistry Terms: Chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic effect, hypsochromic effect- Dyes: azo and triphenylmethane dyes-Preparation one example Methyl Orange, Malachite green.	12
III	Covalent bond Orbital overlap, hybridization, geometry of organic molecules- CH ₄ , C ₂ H ₄ , and C ₂ H ₂ . Inductive effect. Electrometric, mesomeric, hyperconjugative and steric effects. Effect in properties of compounds. Stereoisomerism Conditions of optical activity-Optical isomerism of tartaric acid, Racemisation, Resolution of racemates- Geometrical isomerism of maleic and fumaric acids.	12
IV	Conductance Types (definition only) - Ostwald dilution law - Kohlraush's law- -Applications Conductometric titrations. 2. pH and its calculations- Buffers in living systems-Action of buffer solutions- Henderson Hasselbalch equation	12
V	Solutions types Liquid in Liquid. Raoult's law- - Deviation from ideal behaviour -positive deviation- Negative deviation- Fractional distillation. Kinetics- Rate, order, molecularity, pseudo first order, determination of order. Effect of temperature on the rate. Energy of activation.	12

Textbook

1. Malik, Wahid U., G.D. Tuli and R.D. Madan. *Selected Topics in Inorganic Chemistry, 7th ed.*, New Delhi S.Chand & Company Ltd., 2007.

Reference Books

1. *Principles of Inorganic Chemistry*, B.R. Puri L.R. Sharma, Shobanlal Nagin Chand & Co.
2. *Inorganic Chemistry*, P.L.Soni, Sultan Chand & Sons.
3. *Organic Chemistry, Vol. 1, 2, 3*, S. M. Mughergee, S.P. Singh, R.P. Kapoor, Wiley Eastern.
4. *Advanced Organic Chemistry*, B.S. Bahl, Arun bahl, S.Chand & Co.
5. *Essentials of Physical Chemistry*, B.S. Bahl and G.D. Tuli, S.Chand & Co.
6. *Text book of Physical Chemistry*, P.L.Soni, D.B. Dharmarke, Sultan Chand & Sons.

Course Designed by	Verified by HOD	Checked by	Approved by
DR.N.VANITHA	DR.LALI GROWTHER		



BACHELOR OF SCIENCE IN MICROBIOLOGY

Programme Code:	MBU	Programme Title: Bachelor of Science in Microbiology		
Course Code:	19MBU04	Course Title	Batch:	2019-2022
		Allied Practical I - Chemistry		I
Hrs/Week:	2		Credits:	1

Course Objectives

1. To infer practical knowledge on volumetric and organic analysis.
2. To distinguish between organic compounds.

Course Outcomes (CO)

K1	CO1	Estimate chemicals by different methods
K2	CO2	Identify the presence of elements
K3	CO3	Distinguish between organic compounds
K4	CO4	Schematize the functional group tests

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	L	S	M	L
CO2	M	S	M	L
CO3	M	S	M	L
CO4	M	S	M	L

S - Strong; M-Medium; L-Low.

19MBU04	Allied Practical I – Chemistry	I
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List of Experiments



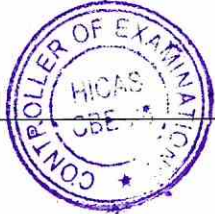
I. VOLUMETRIC ANALYSIS:

1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid- standard oxalic acid.
3. Estimation of oxalic acid- standard sulphuric acid.
4. Estimation of ferrous sulphate- standard Mohr salt solution.
5. Estimation of KMnO_4 - standard ferrous sulphate.

II. ORGANIC ANALYSIS:

systematic analysis Ko

1. Detection of Elements (N, S, Halogens).
2. To distinguish between aliphatic and Aromatic.
3. To distinguish between saturated and unsaturated.
4. Functional group tests for phenols, acids (mono and di), aromatic primary amine, amide, diamide, carbohydrate, Functional groups characterized by confirmatory test.

Course Designed by	Verified by HOD	Checked by	Approved by
 DR.N.VANITHA	 DR.LALI GROWTHER		

BACHELOR OF SCIENCE IN MICROBIOLOGY

Programme Code:	MBU	Programme Title: Bachelor of Science in Microbiology		
Course Code:	19MBU05	Course Title		Batch:
		Microbial Physiology and Metabolism		2019-2022
Hrs/Week:	5		Credits:	5

Course Objectives

1. To transfer knowledge on various aspects of Microbial physiology and metabolism.
2. To relate the microbial biosynthetic pathway and signaling of molecules.

Course Outcomes (CO)

K1	CO1	Define the concepts of nutritional requirements and growth of bacteria
K2	CO2	Associate the metabolic pathways involved in aerobic respiration
K3	CO3	Interpret the pathways of anaerobic respiration and fermentation
K4	CO4	Evaluate the microbial biosynthetic pathways

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	M	L	L
CO2	S	M	L	L
CO3	S	M	L	L
CO4	S	M	L	L

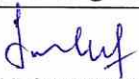
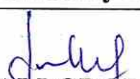

S - Strong; M-Medium; L-Low.

19MBU05	MICROBIAL PHYSIOLOGY AND METABOLISM	II
Unit No.	Topics	Hours
I	Nutrition Nutritional requirements of microorganisms –macro elements, micro elements and growth factors, nutritional groups of microbes - transport mechanisms and types-simple diffusion – facilitated diffusion- active transport – group translocation - Ion transport. Growth curve – Generation time – factors influencing microbial growth – batch, continuous, synchronous growth - diauxic growth. Methods of evaluating microbial growth.	12
II	Aerobic respiration EMP – HMP – ED pathways – TCA cycle- electron transport chain (ETC) – components, comparison of Mitochondrial and Bacterial ETC - oxidative and Substrate level phosphorylation, uncouplers and Inhibitors.	12
III	Anaerobic respiration and Fermentation Anaerobic respiration – sulphur, nitrogenous compounds, and CO ₂ as final electron acceptor - Methanogenesis - Fermentation – alcoholic, lactic acid, propionic, butanediol and mixed acid fermentation.	12
IV	Cell Signalling and Photosynthesis Signalling molecules and their receptors - Functions of cell receptors – quorum sensing. Photosynthesis in green bacteria, purple bacteria and cyanobacteria – oxygenic and anoxygenic, carbon dioxide fixation.	12
V	Biosynthesis Biosynthesis of bacterial cell wall - Biosynthesis of aminoacids (Pyruvate family)- Biosynthesis of fatty acids - general pathway-Biosynthesis of purine and pyrimidine nucleotides denovo and salvage pathways- bioluminescence	12

Text Book: Caldwell DR., "Microbial physiology and Metabolism", WMC Brown Publishers, New Delhi. 1995

Reference Books

1. Moat, A.G. and Foster, J.W., "Microbial Physiology", Springer, New York. 2002
2. Schlegel HG., "Microbiology" Cambridge University press, London.2009
3. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R., "Microbial Physiology", McGraw-Hill Higher Education New York.2008
4. Lehninger, Nelson and Cox., "Principles of Biochemistry", W.H.Freeman & Company, New York. 2013

Course Designed by	Verified by HOD	Checked by	Approved by
 DR.LALI GROWTHER	 DR.LALI GROWTHER		

BACHELOR OF SCIENCE IN MICROBIOLOGY

Programme Code:	MBU	Programme Title: Bachelor of Science in Microbiology		
Course Code:	19MBU06	Course Title	Batch:	2019-2022
		PRACTICAL II - MICROBIAL PHYSIOLOGY AND METABOLISM		II
Hrs/Week:	5		Credits:	3

Course Objectives

1. To develop practical knowledge on physiological condition in microbes.
2. To demonstrate the biochemical characterization of microbes.

Course Outcomes (CO)

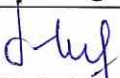
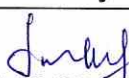

K1	CO1	Estimate the growth of Microorganism by different methods
K2	CO2	Interpret the knowledge on biochemical characterization of microorganisms
K3	CO3	Experiment the degradation of polymers by microorganisms
K4	CO4	Associate the factors affecting microbial growth

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	M	L	L
CO2	S	M	M	L
CO3	S	M	L	L
CO4	S	M	M	L

S - Strong; M-Medium; L-Low.

19MBU06	PRACTICAL II - MICROBIAL PHYSIOLOGY AND METABOLISM	II
<p>LIST OF EXPERIMENTS</p> <ol style="list-style-type: none"> 1. Determination of generation time <ol style="list-style-type: none"> a. Neubauer counting chamber. b. Turbidity. c. Viable count 2. Biochemical characterization: <ol style="list-style-type: none"> a) IMViC tests. b) Catalase, Oxidase c) Urease and nitrate tests. d) Triple sugar iron agar test. 3. Carbohydrate fermentation tests. 4. Hydrolysis test: <ol style="list-style-type: none"> a. Starch hydrolysis. b. Gelatin hydrolysis. c. Casein hydrolysis. 5. Effect of pH and temperature on growth of microbes. 6. Effect of salinity on growth of microbes. 		

Course Designed by	Verified by HOD	Checked by	Approved by
 DR.LALI GROWTHER	 DR.LALI GROWTHER		

BACHELOR OF SCIENCE IN MICROBIOLOGY

Programme Code:	MBU	Programme Title: Bachelor of Science in Microbiology		
Course Code:	19MBU07	Course Title		Batch: 2019-2022
		ALLIED - BIOMOLECULES (MIC)		II
Hrs/Week:	4		Credits:	3

Course Objectives

1. To discover the structure and properties of biomolecules.
2. To outline the classification of biomolecules.

Course Outcomes (CO)

K1	CO1	Describe the structure and properties of carbohydrates
K2	CO2	Summarize the structure and classification of amino acids
K3	CO3	Illustrate the properties of lipids
K4	CO4	Categorize enzymes and their functions

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	L	M	S	L
CO2	L	S	L	L
CO3	L	M	M	L
CO4	L	S	S	M


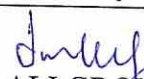

S - Strong; M-Medium; L-Low.

19MBU07	ALLIED - BIOMOLECULES (MIC)	II
Unit No.	Topics	Hours
I	Carbohydrates Monosaccharides, disaccharides and polysaccharides - classification, structure, biological and physiological importance.	09
II	Amino acids Classification of amino acids – essential amino acids – properties – zwitter ion – isoelectric. Proteins: classification and function of proteins- structural level of organization.	10
III	Lipids Classification and properties of lipids. Types of fatty acids – saturated, unsaturated and essential fatty acids. Classification and significance of lipoproteins, glycolipids and phospholipids. Biological significance of steroids and cholesterol.	10
IV	Nucleic acids Components of DNA and RNA. Double helical structure of DNA - Structure and types of RNA.	09
V	Enzymes Classification of enzymes with examples, coenzymes and cofactors (structures not required) – Active site: Lock and key model- induced fit hypothesis. Factors affecting enzyme activity. Enzyme inhibitors. Chemical and industrial applications of enzymes.	10

Text Book: Deb A.C., "Fundamentals of biochemistry", New Central Book Agency, Calcutta.2001

Reference Books

1. Ambika Shanmugam., "Fundamentals of Biochemistry for Medical students" WMC Brown Publishers, New Delhi.2016
2. Sathyanarayana U., "Biochemistry", Books and Allied Pvt. Ltd., New Delhi.2017
3. Lehninger A.L., and Nelson D.L., "Principles of Biochemistry", Cox- CBS Publishers, New Delhi.2013
4. Lubert Stryer., "Biochemistry", Freeman and Company, New York.2002

Course Designed by	Verified by HOD	Checked by	Approved by
 DR.R.MANJU	 DR.LALI GROWTHER		

BACHELOR OF SCIENCE IN MICROBIOLOGY

Programme Code:	MBU	Programme Title: Bachelor of Science in Microbiology		
Course Code:	19MBU08	Course Title	Batch:	2019-2022
		ALLIED PRACTICAL-II – BIOMOLECULES (MIC)		II
Hrs/Week:	2		Credits:	1

Course Objectives

1. To impart practical knowledge on the analysis of biomolecules.
2. To illustrate knowledge on the characterization of biomolecules.

Course Outcomes (CO)

K1	CO1	Analyze carbohydrates qualitatively
K2	CO2	Distinguish mono, di and polysaccharides
K3	CO3	Examine amino acids qualitatively
K4	CO4	Determine the properties of lipids

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	L	L
CO2	S	S	M	L
CO3	S	S	M	L
CO4	M	S	M	L

S - Strong; M-Medium; L-Low.

19MBU08	ALLIED PRACTICAL-II – BIOMOLECULES (MIC)	II
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LIST OF EXPERIMENTS

QUALITATIVE ANALYSIS

1. Analysis of carbohydrates




- a. Monosaccharides - Glucose and Fructose
- b. Disaccharides- Sucrose and Lactose
- c. Polysaccharide- Starch

2. Analysis of Amino acids

- a. Histidine b. Tyrosine. c. Tryptophan d. Arginine

3. Characterization of Lipids

- a. Determination of acid number.
- b. Determination of iodine number.

Course Designed by	Verified by HOD	Checked by	Approved by
 DR.R.MANJU	 DR.LALIT GROWTHER		

BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU09	Course Title	Batch:	2019-2020 only
		MICROBIAL TAXONOMY AND DIVERSITY	Semester:	III
Hrs/Week:	4		Credits:	4

Course Objective

1. To describe the diversity of microbial world and systematic classification system
2. To interpret about the microbes and their distinguished features based on morphological classification of microorganisms.

Course Outcomes (CO)

K1	CO1	Memorize the concepts and techniques in microbial taxonomy
K2	CO2	Demonstrate the classification of systemic bacteriology
K3	CO3	Explain the characteristics and significance of fungal taxonomy
K4	CO4	Describe the general characteristics and reproduction and life cycle of protozoa & viruses

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	L
CO2	M	S	L	L
CO3	S	M	L	L
CO4	M	S	L	L

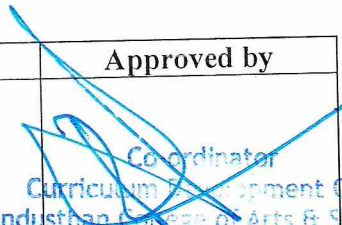
S - Strong; M-Medium; L-Low.

19MBU09	MICROBIAL TAXONOMY AND DIVERSITY	III
Unit No.	Topics	Hours
I	Taxonomy Taxonomy- principle, classification - Phenetic, Phylogenetic, Genotypic; Modern approaches - Numerical, Molecular, Sero-taxonomy, Chemo-taxonomy. Taxonomic Ranks. Techniques to determine Microbial Taxonomy and Phylogeny - Characteristic - Classical and Molecular type (16SrRNA based) - Phylogenetic tree.	09
II	Systematic Bacteriology-II Edition Bergey's manual of systematic bacteriology-II edition - general characteristics and organization - Archaea (Crenarchaeota); Euryarchaeota (Methonobacterium, Halobacterium) - Extremophiles. Proteobacteria - (Alpha- Caulobacter; Beta- Alcaligens; Gamma-Legionella; Delta- Myxococcus; Epsilon- Camphylobacter), Low G+C Gram positive bacteria - Eubacteria; High G+C Gram positive bacteria - Bifidobacterium; Fusobacterium - Characteristics of Actinomycetes.	09
III	Fungal Taxonomy Classification of fungi (Alexopoulos) - General characteristics and organization - Chytridiomycota (Allomyces); Zygomycota (Amoebophilus); Ascomycota (Ascobolus); Basidiomycota (Agaricus); Ustilaginomycota (Malassezia) - economic importance of fungi- role of fungi in Biotechnology.	10
IV	Algae and Protozoa - Taxonomy Occurrence- algal cell structure- Classification of Algae (Fritsch) - General characteristics, morphology and reproduction cycle - Rhodophycophyta, Xanthophycophyta, Euglenophycophyta, Cryptophycophyta, Bacillariophycophyta. Protozoa - General characteristics, classification, life cycle of Sarcodina, Mastigophora, Ciliophora, and Sporozoa.	10
V	Viruses Structure and Types Viruses- General characteristics, classification (Baltimore) and multiplication of viruses. Structure of viruses - virion size, structural properties-helical, icosahedral, complex capsid - nucleic acid -viral envelope and enzymes. Archaeal viruses, Nucleocytoplasmic large DNA (NCLD) viruses.	10

Text Book : Prescott, Hareley.P and Klein.A., "Microbiology", McGraw Hill Publishers, New Delhi 2017

Reference Books

1. Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology Mc Graw Hill Book R. Krieg, 1986 Company
2. Bergey, D. H., Buchanan, R. E., Gibbons, N. E., & American Society for Microbiology. (1974). Bergey's manual of determinative bacteriology. Baltimore: Williams & Wilkins.
3. Alexopoulos, Mims & Blackwell (1996) - Introductory mycology, 4th ed.1996
4. Atlas & Atlas. Microbiology. Pearson Publications. 4th Edition.2017

Course Designed by	Verified by HOD	Checked by	Approved by
DR.R.MANJU	DR.LALI GROWTHER		 Coordinator Curriculum Development Cell Hindustan College of Arts & Science, Coimbatore-641 028.

BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU10	Course Title		Batch:
		MICROBIAL GENETICS		Semester:
Hrs/Week:	4		Credits:	4

Course Objective

1. To extend the knowledge on structure and function of genetic material
2. To differentiate the microorganisms based on their molecular setup

Course Outcomes (CO)

K1	CO1	Describe the genome organization in prokaryotes
K2	CO2	Explain the mechanism of replication, transcription, translation in prokaryotes
K3	CO3	Illustrate the application of gene mutation and repair mechanisms and gene regulation
K4	CO4	Analyze the role of transposable elements and genetic recombination in prokaryotes and eukaryotes

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	M	L	L
CO2	M	S	L	L
CO3	S	M	L	L
CO4	S	M	L	L

S - Strong; M-Medium; L-Low.

19MBU10	Microbial Genetics	III
Unit No.	Topics	Hours
I	Genetic Materials Genetics- historical introduction- DNA as a genetic material – structure and chemical composition of DNA- Watson and Crick model – topological forms of DNA. Organization of genes in prokaryotes - RNA as a genetic material.	09
II	Replication DNA replication – semi conservative- Meselson and Stahl's experiment- replication in Prokaryotes – mechanism and enzymology of replication – helicase, DNA gyrase, polymerases, ligase - rolling circle model – theta replication- Plasmids-concepts, properties, types and applications.	09
III	Transcription and Translation Enzymology and mechanism of transcription in prokaryotes - structure of mRNA, rRNA and tRNA - genetic code – characteristics of genetic code - Enzymology and mechanism of translation in prokaryotes.	10
IV	Mutation and gene regulation Mutation – spontaneous and induced mutations- mutagenesis- - Physical and chemical agents – site specific mutagenesis- mutagenicity testing (Ames test) - DNA damage and repair - regulation of gene activity- operon model- <i>lac</i> and <i>trp</i> operon.	10
V	Gene recombination in bacteria Transformation – transduction (Specialized & Generalized)-conjugation F^+ v/s F^- , Hfr^+ v/s F^- - recombination – homologous recombination - site specific recombination and Transposable elements in prokaryotes – Insertion sequences-composite & non-composite transposons, Mu transposon-transposition.	10

Text Book: David Freifelder., "Molecular biology", Narosa publishing house, New Delhi 2004.

Reference Books

1. Gardner, E. J, Simmons, M J & D P Smustard., 2008 "Principles of Genetics", John Wiley & Sons, New York.2008
2. Robert H. Tamarin., "Principles of Genetics", WmC Brown Publishers, New York.2003
3. Lewin.B., "Gene", Oxford University Press, New York 1997
4. Klug .W.S. & Cummings, MR., "Essentials of Genetics", Mentics Hail, NewJersey.1994

Course Designed by	Verified by HOD	Checked by	Approved by
Mrs.C.AJITHA <i>C. Ajitha</i>	DR.LALI GROWTHER <i>Lali Growth</i>		<i>[Signature]</i> Coordinator Curriculum Development Cell Hindusthan College of Arts & Science, Coimbatore-641 028.

BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU11	Course Title	Batch:	2019-2020 only
		PRACTICAL III - MICROBIAL DIVERSITY AND GENETICS	Semester:	III
Hrs/Week:	4		Credits:	2

Course Objective

1. To develop practical knowledge on DNA isolation and separation
2. To illustrate the mutation of microorganisms

Course Outcomes (CO)

K1	CO1	Describe the classification of Microorganisms.
K2	CO2	Summarize the plasmid and chromosomal DNA isolation from bacteria
K3	CO3	Demonstrate the techniques for DNA and protein separation
K4	CO4	Identify the isolation of mutants by various techniques

Mapping of Outcomes


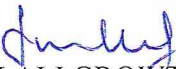
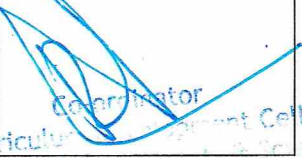
PO CO	PO1	PO2	PO3	PO4
CO1	S	M	L	L
CO2	M	S	L	L
CO3	S	M	L	L
CO4	S	M	L	L

S - Strong; M-Medium; L-Low.

19MBU11	PRACTICAL III - MICROBIAL DIVERSITY AND GENETICS	III
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LIST OF EXPERIMENTS

1. Isolation of thermophiles.
2. Isolation of halophiles from seawater.
3. Observation of representative forms of Anabaena, Volvox, Yeast, Penicillium, Entamoeba and Plasmodium.
4. Isolation of chromosomal DNA from bacteria.
5. Isolation of plasmid DNA from *E. coli*.
6. Separation of DNA by AGE.
7. Separation of proteins by SDS- PAGE.
8. Isolation of mutants using physical agent -UV.
9. Isolation of auxotrophic mutants using chemical agents.
10. Isolation of antibiotic resistant mutants by Gradient plate technique.

Course Designed by	Verified by HOD	Checked by	Approved by
 Mrs.C.AJITHA	 DR.LALI GROWTHER		 Approver

Curricular Development Cell
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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU12	Course Title	Batch:	2019-2020 only
		ALLIED – BIOCHEMISTRY (MIC)	Semester:	III
Hrs/Week:	4		Credits:	3

Course Objective

1. To enumerate the significance of the complex biomolecules and its metabolism
2. To discuss about the various disorders related to each metabolism

Course Outcomes (CO)

K1	CO1	Describe the metabolic pathways and bioenergetics
K2	CO2	Distinguish the properties, physiological functions and deficiency of vitamins and minerals
K3	CO3	Demonstrate the analytical techniques in Biology
K4	CO4	Relate the hormonal imbalance and its disease syndrome

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	M	L	S	L
CO2	M	L	L	S
CO3	L	L	S	M
CO4	L	L	S	M




S - Strong; M-Medium; L-Low.

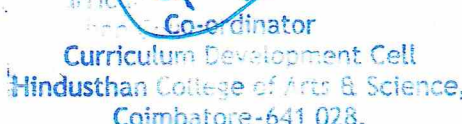
19MBU12	ALLIED – BIOCHEMISTRY (MIC)	III
Unit No.	Topics	Hours
I	Buffer system pH – acid base indicators, principle and application of pH meter - Henderson – Hasselbalch equation – Maintenance of blood pH - buffer systems – respiratory mechanism – renal mechanism - acidosis and alkalosis – distribution of fluids in the body – dehydration. Preparation of solutions- Normality, molarity and molality.	09
II	Bioenergetics Basic principles of thermodynamics – entropy, enthalpy and free energy. High energy phosphates - ATP - oxidation – reduction reactions – Oxidoreductases - oxidases, dehydrogenases, oxygenases, – organization of the respiratory chain in mitochondria.	09
III	Vitamins and Minerals Classification, properties and physiological functions of vitamins – fat soluble – (A,D,E and K) and water soluble (B and C) – deficiency – Macroelements – Physiological importance of Calcium, Phosphorus, Magnesium, Sodium and Potassium – Trace elements – Physiological functions of Iron, Copper , Zinc, Selenium and Iodine	10
IV	Hormones & Inborn errors of Metabolism General characteristics – classification – functions of thyroid stimulating hormone (TSH) – oxytocin – vasopressin – thyroid – tyrosine – pancreas – insulin – diabetes. Hereditary anemias – sickle cell anemia and thalassemia – errors of carbohydrate (galactosemia) and protein metabolism (phenylketonuria) – disease and syndromes.	10
V	Analytical techniques and its application Shaker, Rotatory vacuum evaporator, Sonicator-Types of centrifuge – low and high speed, Ultra centrifuge- UV and Visible spectrophotometer-IR spectroscopy- FTIR-principle and application- Paper, TLC, Ion exchange, HPLC, AGE and PAGE.	10

Text Book: Deb A.C., "Fundamentals of biochemistry", New Central Book Agency, Calcutta.2011

Reference Books

1. Ambika Shanmugam., "Fundamentals of Biochemistry for Medical students" WMC Brown Publishers, New Delhi.2008
2. Sathyanarayana U., "Biochemistry", Books and Allied Pvt. Ltd., New Delhi.2008
3. Lehninger A.L., and Nelson D.L., "Principles of Biochemistry Cox- CBS Publishers, New delhi.2005
4. Lubert Stryer., "Biochemistry", Freeman and Company, New York.2002
5. Upadhyay & Upadhyay. Biophysical Chemistry. 2010 Edition. Himalaya Publishing House.2010
6. Boyer, Rodney, F. Benjamin and Cummins, Modern Experimental Biochemistry. 2nd Edition.1993

Course Designed by	Verified by HOD	Checked by	Approved by
 Ms.T.KRITHIKA	 DR.LALI GROWTHER		


 Co-ordinator
 Curriculum Development Cell
 Hindusthan College of Arts & Science,
 Coimbatore-641 028.

BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU13	Course Title	Batch:	2019-2020 only
		ALLIED PRACTICAL-III – BIOCHEMISTRY (MIC)	Semester:	III
Hrs/Week:	2		Credits:	1

Course Objective

1. To develop practical knowledge on biochemistry
2. To demonstrate the preparation of molar solutions

Course Outcomes (CO)

K1	CO1	Identify the pH in solutions
K2	CO2	Describe the preparation of Molar and Normal solutions
K3	CO3	Demonstrate the estimation of Proteins and carbohydrates
K4	CO4	Experiment the estimation of fatty acids

Mapping of Outcomes


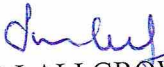

CO \ PO	PO1	PO2	PO3	PO4
CO1	M	L	S	L
CO2	M	L	L	S
CO3	L	L	S	M
CO4	L	L	S	M

S - Strong; M-Medium; L-Low.

19MBU13	ALLIED PRACTICAL-III – BIOCHEMISTRY (MIC)	III
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LIST OF EXPERIMENTS

1. Measurement of pH
2. Preparation of Buffers – Acids and Alkaline Range
3. Preparation of Solutions (Molar and Normal Solutions)
4. Protein estimation (Lowry *et al*)
5. Quantitative determination of protein by Bradford method
6. Determination of Maximum absorption (μ_{max}) spectra of standard Proteins
7. Quantitative determination of carbohydrate by Anthrone method
8. Estimation of Carbohydrates(DNS method)
9. Estimation of vitamins products other than biological sample
10. Study of Proteins-Primary, Secondary and tertiary structures with the help of models

Course Designed by	Verified by HOD	Checked by	Approved by
 Ms. T. KRITHIKA	 DR. LALI GROWTHER		 Coordinator Curriculum Development Cell

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU14	Course Title	Batch:	2019-2020 only
		IMMUNOLOGY	Semester:	IV
Hrs/Week:	4		Credits:	4

Course Objective

1. To stimulate knowledge on Immune system, and its related diseases.
2. To describe about the various Immunotechniques

Course Outcomes (CO)

K1	CO1	Describe the Immune system and immune response, types of antigen and antibodies and complement
K2	CO2	Distinguish about Hypersensitivity and Autoimmune diseases
K3	CO3	Stimulate the knowledge about grafting and immunohematology
K4	CO4	Illustrate the principles of serology in diagnostics

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	M	L	S	L
CO2	M	L	L	S
CO3	L	L	S	M
CO4	L	L	S	M




S - Strong; M-Medium; L-Low.

19MBU14	IMMUNOLOGY	IV
Unit No.	Topics	Hours
I	Immune system History and Scope of Immunology - Types of immunity – innate and acquired. Hematopoiesis Cell and Organs involved in immune system - Phagocytosis, apoptosis and necrosis.	09
II	Antigen and Antibody Antigen: types, chemical and molecular nature: haptens, adjuvants. Immunoglobulins types - structure and functions. Complement pathways - Classical and Alternate	09
III	Hypersensitivity and Auto immune diseases Allergy and Hypersensitivity - Classification types(I, II, III & IV) and Mechanisms – Immunodeficiency diseases (SCID & AIDS)- auto immune diseases and their treatments- systemic and organ specific auto immune diseases.	10
IV	Grafting and Immunoematology Types of grafting, mechanism of graft rejection – MHC- HLA typing - tumors of the immune system - Monoclonal antibodies and its applications (Hybridoma technology) Immunoematology - Blood transfusion - ABO grouping - Rh factor - Tissue typing	10
V	Immunotechnology Detecting antigen – antibody interaction – cross reactivity - affinity- avidity– precipitation - VDRL – agglutination - Blood grouping, WIDAL, RIA – ELISA – western blotting – immunoprecipitation – immunofluorescence, complement fixation test.	10

Text Books: Coleman, R.M., Lourbard, M.F and Sicard, R.E.. "Fundamental immunology", W.H. Freeman and co., New York 1997

Reference Books

- 1) Kuby, J., "Immunology", W.H. Freeman and co., New York..2006
- 2) Roitt, I.M., "Essential of Immunology", Black Well Scientific Publishers, New York.2017
- 3) Tizard, R.I., "Immunology-An Introduction", Saunder's College publishers, Philadelphia.2000
- 4) Ashim K. Chakravarthy., "Immunology", TataMcGraw-Hill, New Delhi.1996

Course Designed by	Verified by HOD	Checked by	Approved by
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Curriculum Development Cell
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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		Batch:	2019-2020 only
Course Code:	19MBU15	Course Title		Semester:	IV
		MEDICAL BACTERIOLOGY		Credits:	4
Hrs/Week:	4				

Course Objective

1. To discover the pathophysiology of bacterial infections
2. To infer about the disease diagnosis

Course Outcomes (CO)

K1	CO1	Demonstrate the types of infections, sources and methods of transmission.
K2	CO2	Explain the pathogenicity of Gram positive organisms
K3	CO3	Classify the common gram negative bacterial infections
K4	CO4	Describe the pathogenicity of Mycobacteria, Spirochaetes and Rickettsiae

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	M	L	L
CO2	S	M	L	L
CO3	S	M	L	L
CO4	L	L	S	M

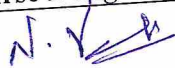


S - Strong; M-Medium; L-Low.

19MBU15	Medical Bacteriology	IV
Unit No.	Topics	Hours
I	Infections Normal microflora of human body - Sources and types of infections- methods of transmission – Virulence Factors - adhesion, exotoxins and endotoxins - Epidemic, Endemic and Pandemic diseases- Infectious disease cycle.	09
II	Gram positive organisms Gram positive organisms - Morphology, cultural characteristics, pathogenicity <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Pneumococcus</i> , <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> , <i>Clostridium tetani</i> and <i>Clostridium botulinum</i> .	09
III	Gram negative organisms Gram negative organisms Morphology, cultural characteristics, pathogenicity and clinical manifestations of <i>E. coli</i> , <i>Klebsiella pneumoniae</i> , <i>Salmonella typhi</i> , <i>Shigella dysenteriae</i> , <i>Pseudomonas aeruginosa</i> , <i>Vibrio cholerae</i> , <i>Neisseria gonorrhoeae</i> , <i>Neisseria meningitidis</i> and <i>Helicobacter pylori</i>	10
IV	Mycobacteria, Spirochaetes and Intracellular parasites Morphology, cultural characteristics, pathogenicity and clinical manifestations of, <i>Mycobacterium tuberculosis</i> , <i>Mycobacterium leprae</i> , <i>Spirochaetes – Treponema pallidum</i> , and <i>Leptospira icterohaemorrhagiae</i> , <i>Mycoplasma pneumoniae</i> , <i>Rickettsia rickettsii</i> and <i>Chlamydia trachomatis</i> .	10
V	Diagnosis Laboratory diagnosis of common bacterial infections– Process of sample collection, transportation and processing-Molecular methods of diagnosis (PCR, DNA Probes). Antibiotics - classification based on mode of action-Antibacterial susceptibility testing- drug resistance – MRSA - VISA – ESBL.	10

Text Books: Ananthanarayan and Jayaram Paniker., "Textbook of Microbiology", University Press India Pvt Ltd. New Delhi. 2017

Reference Books

1. Jawetz E Melnic JL and Adelberg EA , "Review of Medical Microbiology", Lange Medical Publications, USA.1974
2. Mackie and Mc catney, " Medical Microbiology No I and II", Churchill Livingstone, USA. 1996
3. Bailey and Scotts "Diagnostic Microbiology", 9th edition, Baron and Finegold CV Mosby Publications, USA. 1994
4. David Greenwood "Medical Microbiology", Churchill Livingstone, USA.2012

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology	Batch:	2019-2020 only
Course Code:	19MBU16	Course Title PRACTICAL IV MEDICAL BACTERIOLOGY AND IMMUNOLOGY	Semester:	IV
Hrs/Week:	4		Credits:	2

Course Objective

1. To illustrate on bacteriological techniques
2. To demonstrate the immunological techniques

Course Outcomes (CO)




K1	CO1	Memorize knowledge about the characterization of infectious agents.
K2	CO2	Describe the antibiotic susceptibility testing
K3	CO3	Demonstrate antigen and antibody interaction
K4	CO4	Calculate the Blood cell count and hemoglobin content

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	M	S	L	M
CO2	S	M	S	L
CO3	S	L	S	M
CO4	L	L	S	M

S - Strong; M-Medium; L-Low.

19MBU16	PRACTICAL IV MEDICAL BACTERIOLOGY AND IMMUNOLOGY	IV
LIST OF EXPERIMENTS		
<p>1. Identification of clinically important bacteria:</p> <ol style="list-style-type: none"> a. <i>Staphylococcus aureus</i> b. <i>Streptococcus pyogenes</i> c. <i>Escherichia coli</i> d. <i>Salmonella typhi</i> e. <i>Klebsiella pneumoniae</i> f. <i>Pseudomonas aeruginosa</i> g. <i>Proteus mirabilis</i> <p>2. Antibiotic sensitivity testing – Kirby Bauer method.</p> <p>3. Agglutination - Blood grouping, WIDAL, RPR, ASO.</p> <p>4. ELISA.</p> <p>5. Precipitation -</p> <ol style="list-style-type: none"> a) Immunodiffusion-Radial and Ouchterlony's double Immunodiffusion. b) Immunoelectrophoresis -Rocket and counter current. <p>6. ESR.</p> <p>7. Erythrocyte count.</p> <p>8. Leukocyte count.</p> <p>9. Differential count.</p> <p>10. Estimation of Hemoglobin.</p>		

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU19	Course Title	Batch:	2019-2020 only
		GENETIC ENGINEERING	Semester:	V
Hrs/Week:	5		Credits:	5

Course Objective

1. To impart knowledge on the basic concepts of genetic engineering.
2. To describe general techniques used to modify gene and to analyze the benefits and drawbacks of manipulating gene.
3. To expose the application of transgenesis in research.
4. To educate students in the application of genetic engineering technologies in microbial product development

Course Outcomes (CO)

K1	CO1	Recall the knowledge on enzymes and vectors used in genetic engineering
K2	CO2	Make use of the concepts and methods involved in prokaryotic gene transfer
K3	CO3	Discover the ideas and modalities in the development of transgenic plants, animals and its applications
K4	CO4	Compare genetic engineering technologies thereby deduce the concept of microbial synthesis of commercial products

Mapping of Outcomes

PO CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	M	S	S
CO3	S	S	S	M
CO4	S	S	S	M

S - Strong; M-Medium; L-Low.

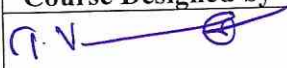
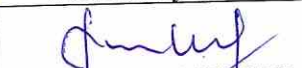


19MBU19	GENETIC ENGINEERING	V
Unit No.	Topics	Hours
I	Restriction Enzymes and cloning vectors Outline of genetic Engineering- Nucleases: Exonucleases , Endonucleases, Restriction enzymes, RNases, Methylases, Polymerases: DNA Pol I, Ligases: T4 DNA Ligase, <i>E.coli</i> DNA Ligase, desirable properties of vectors, Plasmid Vectors - pSC101 & pBR322- Phage Vectors - Cosmids - Phagemids - BACs and YACs	12
II	Gene Transfer Techniques Physical – biolistic method , chemical- Calcium chloride and DEAE methods , biological <i>in vitro</i> package method - Screening and selection of recombinants- direct method – selection by complementation, marker inactivation , Indirect methods- Immunological and genetics.	12
III	Transgenic plants and animals Ti plasmid – insect, virus, herbicide resistant plants – microbial insecticides – bacteria, fungi and viruses. Transgenic animals – mice – retroviral method – DNA microinjection method – embryonic stem cell method- Application- Transgenic – sheep.	12
IV	Applications of Genetic engineering Genomic Library and cDNA Library. RAPD, RFLP, micro array, blotting techniques and PCR, types of PCR and its applications. DNA finger printing technology, Human genome project, history and applications.	12
V	Microbial synthesis of commercial products Proteins (Insulin) -Pharmaceuticals – Interferons - Human growth hormone (somatostatin) - Antibiotics (cephalosporin) –Biopolymers (Xanthan gum).	12

Text Books:

1. T.A Brown, "An introduction to Gene Cloning", (2018). Chapman and Hall, New York..
2. Old. RW and Primrose., "Principle of Gene Manipulation", 2001. Blackwell Scientific Publication ,Boston.

Reference Books

1. Winnecker, E.D., "From gene to clones, Introduction to Gene Technology", 2015. VCH Publication, FRG.
2. Bernard. R Glick and Jack J Pasternak., "Molecular biotechnology", 2010. Panima Publishing Corporation, New York.
3. U.Sathyannarayana., "Biotechnology", 2020. Books and Allied (P) Ltd., New Delhi.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU20	Course Title	Batch:	2019-2020 only
		ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY	Semester:	V
Hrs/Week:	5		Credits:	5

Course Objective

1. To understand the role of microbes in soil characteristics, microbial interaction and biogeochemical cycling
2. To know the importance of biofertilizers and biopesticides
3. To obtain knowledge on various techniques involved in biofertilizers and biopesticides production
4. To acquire knowledge on microbial decomposition and bioremediation.

Course Outcomes (CO)

K1	CO1	State the diversity of microorganism and microbial communities inhabiting ecological habitats.
K2	CO2	Utilize the factors that regulate interactions between microbes.
K3	CO3	Examine the role of microorganisms in biogeochemical cycles
K4	CO4	Evaluate the microbes for their ability to decompose

Mapping of Outcomes

CO	PO	PO1	PO2	PO3	PO4
CO1		S	S	M	L
CO2		S	S	L	L
CO3		S	S	M	L
CO4		S	S	S	M

S - Strong; M-Medium; L-Low.

1. To understand the role of microbes in soil characteristics, microbial interaction and biogeochemical cycling
 2. To know the importance of biofertilizers and biopesticides
 3. To obtain knowledge on various techniques involved in biofertilizers and biopesticides production
 4. To acquire knowledge on microbial decomposition and bioremediation.


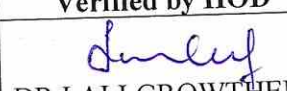
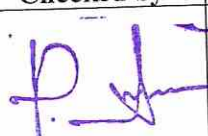
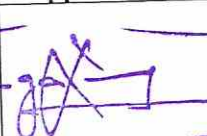
19MBU20	ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY	V
Unit No.	Topics	Hours
I	Aerobiology Introduction to microorganisms in air – sources of microbes in air-droplet, droplet nuclei, infectious dust, factors affecting air microflora - sampling of air – settling under gravity, centrifugal action, filtration, impingement, electrostatic precipitation, air pollution.	12
II	Aquatic Microbiology Distributions of microorganism in water bodies – water borne disease - bacteriological examination of water, MPN, MF techniques, Indicator organisms - BOD, COD, eutrophication, waste water treatment.	12
III	Soil Microbiology and Biogeochemical cycle Factors influencing soil microbes - bacteria, fungi, actinomycetes (distributions) microbial interaction- commensalism, mutualism, syntrophism, synergism –protocooperation ammensalism, parasitism and predation. Nitrogen cycle, carbon cycle, phosphorus cycle, sulphur cycle.	12
IV	Agricultural Microbiology Nitrogen fixation – Symbiotic and non-symbiotic, Phosphate solubilizer Mycorrhizae – cultivation and mass production of Rhizobium, Azotobacter, Azospirillum, Azolla and Cyanobacteria. Lichens. Methods of application. Biopesticides – <i>Bacillus thuringiensis</i> , <i>Pseudomonas syringae</i> . Biocontrol agents – Mycofungicides, Mycoherbicides, Mycoinsecticides.	12
V	Applied Ecology Microbial decomposition- cellulose, hemicellulose, lignin, pectin and chitin- factors influencing degradation- solid waste treatment- composting - vermi composting – bioremediation-Bioplastics	12

Text Books:

1. R.R Mishra., "Soil microbiology", (2020). CBS Publishers and distributors, New Delhi.
2. K.Vijaya Ramesh., "Environmental Microbiology", 2019. MJ Publishers, Chennai.

Reference Books

1. Joseph. C Daniel., " Environmental aspects of microbiology", 2016. Brightsun Publication, London.
2. Ronald M. Atlas., "Microbial ecology Fundamentals and Applications-Richard Bartha", 1997. Pearson Publication, Germany.
3. N.S. Subba Rao., "Soil microbiology", 2017. Oxford and IBH Publication, New Delhi.
4. Martin Alexander., "Introduction to Soil Microbiology" 1977. John Wiley and Sons, New York and London

Course Designed by	Verified by HOD	Checked by	Approved by
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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU21	Course Title	Batch:	2019-2020 only
		FOOD AND INDUSTRIAL MICROBIOLOGY	Semester:	V
Hrs/Week:	5		Credits:	5

Course Objective

1. To understand the key concepts in food preservation and spoilage
2. To gain knowledge on various fermented food and dairy products
3. To learn about fermentation techniques and fermenter
4. To gain knowledge about upstream and downstream processes in a fermentation process

Course Outcomes (CO)

K1	CO1	Define the concepts food and dairy micro flora, preservation and spoilage
K2	CO2	Identify the tests used in industries and fermented food products, food laws and regulations as per the WHO standards
K3	CO3	Discover the design of different types of fermenter and categorizing different media and nutrients for industrial fermentation
K4	CO4	Determine the process of product recovery and purification

Mapping of Outcomes

CO	PO	PO1	PO2	PO3	PO4
CO1		S	M	S	M
CO2		S	M	M	M
CO3		S	M	S	M
CO4		S	M	S	M

S - Strong; M-Medium; L-Low.

(Signature)
 (Date)
 (Institution Name)



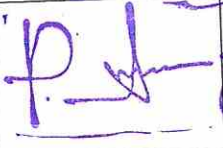
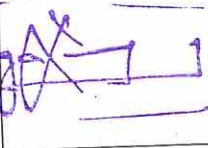
19MBU21	FOOD AND INDUSTRIAL MICROBIOLOGY	V
Unit No.	Topics	Hours
I	Food microflora and spoilage Introduction- Importance of food microbiology – types of microorganisms in food – factors influencing microbial growth in food (extrinsic and intrinsic) – Contamination and spoilage – vegetables and fruits, meat, milk, fish, poultry, canned foods. Food poisoning and food borne infections – bacterial and mycotoxins. Principles of food preservation – Asepsis – physical and chemical methods.	12
II	Fermented food and quality assurance Fermented food – pickled cucumber, sauerkraut, soy sauce, Bread, Idly, fermented dairy product – yoghurt, cheese and kefir. Food laws and regulations – HACCP - Codex alimentarius. Dairy processing plant sanitation - utilization and disposal of dairy by-products – whey.	12
III	Bioreactor-Upstream process Fermentation definition and types- submerged and solid state. Fermentor design and its types (Tower, cylindroconical & airlift)- Substrate for industrial fermentation- solid and liquid media- Carbon, nitrogen, vitamin, mineral sources, buffers, precursors, inhibitors, inducers and antifoam agents- Sterilization of media -Industrially important strains- Screening methods- Strain development - Mutation, Recombination and protoplasmic fusion- Strain preservation.	14
IV	Downstream Process Product recovery and purification - intracellular and extracellular products- cell disruption, centrifugation, filtration, flotation chromatography, flocculation, solvent extraction, precipitation, drying, crystallization - packaging and marketing	10
V	Microbial products Commercial production of beer, wine, antibiotics- Penicillin, Enzymes- Amylase. Amino acids - Glutamic acid. Immobilization of enzymes, Production of baker's yeast, Spirulina, bioethanol production- flavouring agents.	12

Text Books:

1. Adams M.R. and M.O. Moss., "Food Microbiology", (2008) The royal Society of Chemistry, Cambridge, New York.
2. A.H. Patel., "Industrial Microbiology", (2016). Macmillan India Publishers, New Delhi.

Reference Books

1. Fraizer W.C. and Westhoff D.C., "Food Microbiology", 2017. TATA McGraw Hill Publishing Company Ltd. New Delhi.
2. James M. Jay, Martin J. Loessner, David A. Golden., "Modern Food Microbiology," 2005. Springer New York.
3. Stanbury P T and Whitaker., "Principles of Fermentation Technology", 2016. Pergamon Press, New York.
4. Casida, L E JR., "Industrial Microbiology", 2019. New Age International Publishers, New Delhi.
5. Prescott and Rehm. " Industrial Microbiology", 2004. Wiley and Sons, France.
6. Nduka Okafor., "Modern Industrial Microbiology and Biotechnology", 2007. CRC Press, New Delhi.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU22A	Course Title	Batch:	2019-2020 only
Hrs/Week:	5	TEXTILE MICROBIOLOGY	Semester:	V
			Credits:	5

Course Objective

1. To emphasis the knowledge of textile antimicrobial preparation and validation.
2. To understand the use of polymer modification methods in textile industry.
3. To assess the various antimicrobial textile preparation techniques.
4. To understand the importance of medical textiles and validation methods.

Course Outcomes (CO)

K1	CO1	Match the antimicrobial agents and the pathogens associated
K2	CO2	Experiment with the Polymers used in textiles and antimicrobial textiles
K3	CO3	Categorize the standard assessment methods used in textile industries
K4	CO4	Evaluate commercial antimicrobial textiles for human welfare.

Mapping of Outcomes

CO	PO	PO1	PO2	PO3	PO4
CO1		L	M	S	S
CO2		S	S	M	M
CO3		S	M	M	M
CO4		M	S	S	M

S - Strong; M-Medium; L-Low.

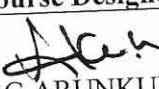

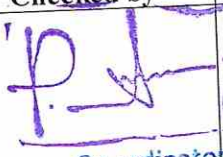
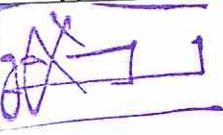
19MBU22A	TEXTILE MICROBIOLOGY	V
Unit No.	Topics	Hours
I	Introduction to textile microbiology History - pathogen associated with textiles - antimicrobial textiles antimicrobial agents, plant extracts, metals, disinfectants, antibiotics, biopolymers - mode of action of antimicrobials.	12
II	Modification of polymers Modification methods spun-in additives and post-treatment – durable press finishing with – DMDHEU, BTCA, citric acid – advanced finishing methods – micro encapsulation methods.	12
III	Antimicrobial textile preparation and assessment Antimicrobial coating methods – pad - dry - reactive dye - corona - plasma technology. Standard methods (AATCC – 100, AATCC-124, AATCC-147), Chemical characterization – FTIR, topographic analysis – SEM. Physical and chemical properties of antimicrobial textiles.	12
IV	Medical textiles Dressing types and usage, dressing for wound healing, modern wound dressing-polymeric wound dressing, future trends in medical textiles.	12
V	Validation of antimicrobial technology Antimicrobial treatment - verification – antimicrobial regulation – modern textile characterization methods – general characterization of textiles – physical, chemical resistance – thermal properties.	12

Text Books:

1. Yuan Gao and Robin Cranston. "Recent Advances in Antimicrobial Treatments of Textiles Textile Research Journal" (2008). SAGE publications.
2. Rajendran, R. "Biotechnological Application in Textile Industry-Antimicrobial Textiles", 2004. Maheswari, Industrial Exploitation of Microorganisms.

Reference Books

1. Edlich, R. F., Panek, P. H., Rodeheaver, G. T., Kurtz, L. D. and Edgerton, M. T., 1974. Surgical sutures and infection: A biomaterial evaluation. Journal of Biomedical Materials Research, 8: 115–126.
2. Gard, PR., J.P. Reynolds, G.W. Hanlon. Use of Chlorhexidine-Releasing Nylon Fibres to Reduce Device-Related Uterine Infections. 2004. Gynecol Obstet Invest.
3. R.C Dubey., "Textbook of Microbiology", 2013. S. Chand and Company Ltd, New Delhi.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU22B	Course Title	Batch:	2019-2020 only
		PHARMACEUTICAL MICROBIOLOGY	Semester:	V
Hrs/Week:	5		Credits:	5

Course Objective

1. To understand the mechanisms of action of antibiotics and antimicrobial agents
2. To know about the various drug targets and drug delivery systems
3. To have the broad knowledge on microbiological product evaluation
4. To be familiar with regulatory guidelines and agencies.

Course Outcomes (CO)

K1	CO1	Relate types of antibiotics and their modes of action.
K2	CO2	Demonstrate drug targeting and delivery systems
K3	CO3	Explain sterility testing of Pharmaceutical products
K4	CO4	Summarize the regulatory aspects and guidelines

Mapping of Outcomes

CO	PO	PO1	PO2	PO3	PO4
CO1		S	M	L	L
CO2		M	S	L	L
CO3		S	M	L	L
CO4		M	S	L	L

S - Strong; M-Medium; L-Low.

MBU 19MBU22B
 PHARMACEUTICAL MICROBIOLOGY
 SEMESTER V
 2019-2020





19MBU22B	PHARMACEUTICAL MICROBIOLOGY	V
Unit No.	Topics	Hours
I	Antibiotics and synthetic antimicrobial agents Introduction and Scope of Pharmaceutical Microbiology - Aminoglycosides, β lactams, tetracyclines, ansamycins, macrolide antibiotics –mode of action- Antifungal antibiotics, antitumor substances. Peptide antibiotics, chloramphenicol, sulphonamides and quinolone. Antimicrobial agents - Chemical disinfectants, antiseptics and preservatives.	12
II	Drug targets and delivery system Need for Developing New Drugs – Combinatorial synthesis – Drug developing system –Rational drug design - Immobilization procedures for pharmaceutical applications (liposomes). Macromolecular, cellular and synthetic drug carriers Molecular principles of drug targeting - Drug delivery system in gene therapy. Biosensors in pharmaceuticals.	12
III	Sterility Testing Microbial Examination of Non-sterile product-Products storage and handling; Growth requirement; Growth Promotion; Indicative and inhibitory properties of the media; Suitability of the test method; Test procedure; Interpretation of the results.	12
IV	Antibiotic potency testing Bacterial endotoxin testing-Gel clot method; LAL reagent sensitivity; Inhibition/Enhancement test; test procedure; Endotoxin calculation; composing sample; Relevant excerpts from guidance for industry -pyrogen and endotoxin testing.	12
V	Quality Assurance and Validation Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry - Regulatory aspects of quality control - Government regulatory practices and policies - FDA perspective. Reimbursement of drugs and biologicals, legislative perspective Quality assurance and quality control in pharmaceuticals -ISO, WHO and US certification.	12

Text Books:

1. D. Golan, A. Tashjian, E. Armstrong, J.Galanter, A.W.Armstrong, R. Arnaout and H.Rose., "Principles of Pharmacology", (2017). Lippincott Williams and Wilkins, New York.
2. Hugel, W.B. and Russel, "Pharmaceutical Microbiology",. 2011. AD.Blackwell Scientific, Oxford

Reference Books

1. J.Hardman, Lee Limbird and A.G. Gilman., "Goodman and Gilman's The Pharmacological Basis of Therapeutics". 2001. Lippincott Williams and Wilkins, New York.
2. Lancini, G. and Parenti, F. "Antibiotics", 2013. Springer-Verlag.
3. Block, S.S. "Disinfection, sterilization and preservation", 2001. Lea and Febigor, Baltimore.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU22C	Course Title		Batch:
		WASTE MANAGEMENT		2019-2020 only
Hrs/Week:	5	Semester:	V	
		Credits:	5	

Course Objective

1. To characterize the types of solid waste and methods of sampling
2. To apply the knowledge for effective solid waste collection and segregation systems
3. To characterize and to manage nuclear waste, E-waste, chemical waste and handling of biomedical wastes
4. To design composting systems, maintain and operate the aerobic and anaerobic composting process for effective organic waste recycling.

Course Outcomes (CO)

K1	CO1	Choose the sources and types of solid waste and assessment of sampling methods
K2	CO2	Develop the process of collection and segregation of waste
K3	CO3	Distinguish nuclear and biomedical wastes and their effects in health and environment
K4	CO4	Conclude the microbial role in management of waste

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	L	M	M	S
CO2	L	S	L	S
CO3	M	L	M	M
CO4	S	L	L	S

S - Strong; M-Medium; L-Low.

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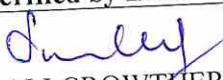
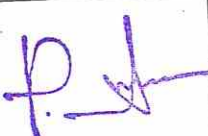
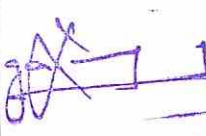
19MBU22C	WASTE MANAGEMENT	V
Unit No.	Topics	Hours
I	Municipal solid waste Definition - Sources and types of solid waste- composition and its determinants of solid waste-factors influencing generation--methods of sampling and characterization.	12
II	Collection and segregation Solid waste – collection services –Transport– transfer stations – types – waste segregation - equalization - reduction in volume and strength.	12
III	Nuclear and e-waste management Characteristics – Types – Uranium mining and processing – Power reactors – Refinery and fuel fabrication wastes – spent fuel – Management of nuclear wastes – Hazard analysis health and environmental effects.	12
IV	Biomedical and chemical wastes management Biomedical wastes – Types – Management – control of biomedical wastes Chemical wastes – Sources – Domestic and industrial - Inorganic pollutants – Environmental effects – Treatment and disposal techniques – Physical, chemical and biological processes – Health and environmental effects.	12
V	Management of wastes Disposal of Solid Wastes – land fill – incineration and composting, recycling- reuse- anaerobic digestion- energy recovery- standards for composting- treated leachates and incineration-Zero waste management.	12

Text Books:

1. George Tchobanoglous., "Integrated Solid Waste Management", (2014). McGraw - Hill, New Delhi.
2. J. Glynn Henry and Gary. W. Heinke., "Environmental Science and Engineering", 1996. Prentice Hall of India, India.

Reference Books

1. Tchobanoglous Thiesen Ellasen., "Solid Waste Engineering Principles and Management", 1977. McGraw – Hill, New Delhi.
2. Prescott and Rehm., " Industrial Microbiology", 2004. Wiley and Sons, France.
3. Nduka Okafor., "Modern Industrial Microbiology and Biotechnology", 2007. CRC Press, New Delhi.

Course Designed by	Verified by HOD	Checked by	Approved by
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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU23	Course Title	Batch:	2019-2020 only
		PRACTICAL V- GENETIC ENGINEERING AND ENVIRONMENTAL MICROBIOLOGY	Semester:	V
Hrs/Week:	4		Credits:	2

Course Objective

1. To impart practical knowledge on the techniques used in Environmental Microbiology
2. To develop basic skills in molecular techniques.
3. To analyze the quality of water
4. To isolate plant growth promoting bacteria.

Course Outcomes (CO)

K1	CO1	Compare restriction enzymes
K2	CO2	Experiment with the selection of transformants
K3	CO3	Categorize plant growth promoting bacteria
K4	CO4	Assess the quality of water

Mapping of Outcomes

CO	PO	PO1	PO2	PO3	PO4
CO1		S	M	S	M
CO2		S	M	S	M
CO3		S	M	L	M
CO4		S	S	M	M

S - Strong; M-Medium; L-Low.

The material is prepared by
 Dr. A. S. Srinivasan, Head of Department
 Microbiology, Anna University, Chennai-600 025



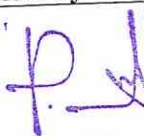
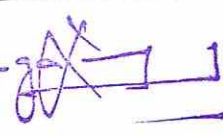
19MBU23	PRACTICAL V- GENETIC ENGINEERING AND ENVIRONMENTAL MICROBIOLOGY	V
LIST OF EXPERIMENTS		
1.	Restriction digestion of DNA	4
2.	Ligation of DNA	4
3.	Competent cell preparation	4
4.	Transformation (blue , white selection)	4
5.	Amplification of DNA using PCR	4
6.	Isolation of free living nitrogen fixers –Azotobacter, Azospirillum	4
7.	Isolation of symbiotic nitrogen fixer -Rhizobium	4
8.	Isolation of ammonifiers, nitrifiers and denitrifiers	4
9.	Isolation of Phosphate solubilizers	4
10.	Estimation of biological oxygen demand (BOD)	3
11.	Estimation of Chemical Oxygen Demand	3
12.	MPN Technique – Detection of potability of water	3
13.	Isolation of phycobionts and mycobionts	3

Text Book:

1. N. Murugalatha, Lali Growther, J. Vimalin Hena, N. Hema Shenpagam, R. Anitha, D. Kanchana Devi, G. Rajalakshmi, *Microbiological Techniques*, 2013, MJP Publisher.

Reference Book

1. James G. Cappuccino, Natalie Sherman, *Microbiology: A Laboratory Manual*, 2014: Pearson.
2. John Vennison., "Laboratory Manual for Genetic Engineering" 2009., PHI Learning Pvt. Ltd.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU24	Course Title	Batch:	2019-2020 only
		PRACTICAL VI – FOOD AND INDUSTRIAL MICROBIOLOGY	Semester:	V
Hrs/Week:	4		Credits:	2

Course Objective

1. To rephrase practical knowledge on the production of enzyme and organic acids
2. To gain knowledge on fermentation aspects of alcohol
3. To develop basic skills in food microbiology
4. To infer the techniques used in food and Industrial microbiology

Course Outcomes (CO)

K1	CO1	Illustrate the quality assessment of food products
K2	CO2	Experiment with the industrial production of enzymes
K3	CO3	Test for the food borne pathogens
K4	CO4	Determine the microbial production of food products

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	M	S	M
CO2	S	M	S	M
CO3	S	M	L	M
CO4	S	S	M	M

S - Strong; M-Medium; L-Low.



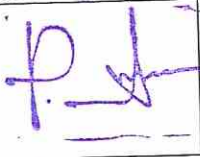
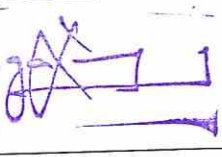
19MBU24	PRACTICAL VI – FOOD AND INDUSTRIAL MICROBIOLOGY	V
LIST OF EXPERIMENTS		
1.	Enzyme production and assay a) Protease b) Amylase	5
2.	Production of organic acid- citric acid by submerged fermentation.	5
3.	Alcohol production / wine- alcohol, acid and sugar estimation	5
4.	Immobilization of cells-Sodium alginate	5
5.	Methylene blue reduction test, Resazurin method	4
6.	Enumeration of aerobic bacteria and fungi in food- Bread and vegetables	4
7.	Detection and confirmation of pathogens from food- Salmonella and Staphylococcus aureus	4
8.	Determination of sterility of canned foods- Fermentation test	4
9.	Direct microscopic examination of curd – observation of Lactobacillus sp.	4
10.	Production of sauerkraut by microorganisms	4
11.	Bioreactor (Demo)	4

Text Book :

N. Murugalaitha, Lali Growther, J. Vimalin Hena, N. Hema Shenpagam, R. Anitha, D. Kanchana Devi, G. Rajalakshmi, Microbiological Techniques, 2013, MJP Publisher.

Reference Books

1. *James G. Cappuccino, Natalie Sherman, Microbiology: A Laboratory Manual, 2014: Pearson.*
2. *Food microbiology: a laboratory manual: Ahmed E. Yousef and Carolyn Carlstrom (Eds.); Wiley-Interscience, Singapore, 2003.*

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU26	Course Title	Batch:	2019-2020 only
Hrs/Week:	5	VIROLOGY	Semester:	VI
			Credits:	5

Course Objective

1. To apply the integrated information in viral reproduction and host interaction.
2. To develop knowledge on the life cycle of phages
3. To evaluate plant viral diseases.
4. To impart knowledge on animal viruses.

Course Outcomes (CO)

K1	CO1	Define the structure and list out the cultivation methods of Viruses
K2	CO2	Identify the life cycle of DNA phages
K3	CO3	Categorize the Life cycle of bacteriophages
K4	CO4	Explain the structure and replication of plant viruses.

Mapping of Outcomes

CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	M	M	L
CO3	S	M	S	M
CO4	S	M	L	S

S - Strong; M-Medium; L-Low.

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 1. To apply the integrated information in viral reproduction and host interaction.
 2. To develop knowledge on the life cycle of phages
 3. To evaluate plant viral diseases.
 4. To impart knowledge on animal viruses.


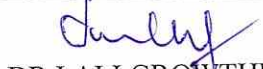


19MBU26	VIROLOGY	VI
Unit No.	Topics	Hours
I	General structure and cultivation of viruses Early development of virology- General, structural properties of virus – helical, icosahedral and complex symmetry. Baltimore system of classification- cultivation of viruses experiment animals, embryonated eggs and cell cultures –Purification and assay of virus.	12
II	Reproduction of DNA phages Reproduction of DNA phages – dsDNA T ₄ lytic cycle – lytic cycle adsorption - penetration- synthesis -assembly - release of phage particles - one step growth experiment. ssDNA phage - ØX 174 replication	12
III	Life cycle of phage Temperate bacteriophages – prophage – integration and excision. Defective phages – λ phage - conversion between lytic & lysogeny - reproduction of RNA phages- Qβ, φ6, MS2.	12
IV	Plant Viruses General properties, structure, genome replication of DNA virus – CaMV and gemini virus- RNA viruses – TMV and BMV- Myco and Phycophages	12
V	Animal Viruses General properties, structure, genome replication, laboratory diagnosis, prophylaxis and treatment of DNA virus–Adeno, Herpes Simplex (1 & 2)- hepatitis (B)- RNA viruses - HIV, ebola, dengue, polio virus- oncogenic viruses, corona virus – SARS CoV-2. Antiviral agents- viral vaccines.	12

Text Books :

1. Prescott L.M, Harley, J.P Klein D.A., 2008. "Microbiology", Wm C Publishers, New Delhi.
2. John Carter., "Virology: Principles and Applications" 2013. Wiley Publications, France.

Reference Books

1. Luria S.E. Darnel, J.E Jr. Baltimore. D and Campbell A., " General Virology", 1978. Wiley and sons, France.
2. Nicholas H. Acheson., "Fundamentals of Molecular Virology", 2011. Wiley Publications, France.
3. Shubhrata.R.Mishra., "Virus and plant diseases", 2004. Discovery publishing house, New Delhi.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU27	Course Title	Batch	2019-2020 only
		MEDICAL MYCOLOGY AND PARASITOLOGY	Semester	VI
Hrs/Week:	5		Credits:	5

Course Objective

1. To impart knowledge on the clinically important fungi and parasites.
2. To deduce the etiology of different mycoses.
3. To distinguish the different pathologies of parasitic infections.
4. To identify clinically significant fungi and parasites by laboratory methods.

Course Outcomes (CO)

K1	CO1	Identify the fungal characteristics, classification and mycoses
K2	CO2	Experiment with the susceptibility testing- CLSI, EUCAST methods
K3	CO3	Compare the life cycle and pathology of parasitic infections and medically important helminthes
K4	CO4	Interpret the examination of fungi and parasite

Mapping of Outcomes

CO	PO	PO1	PO2	PO3	PO4
CO1		L	M	S	S
CO2		S	S	M	M
CO3		S	M	M	M
CO4		M	S	S	M

S - Strong; M-Medium; L-Low.

19MBU27	MEDICAL MYCOLOGY AND PARASITOLOGY	VI
Unit No.	Topics	Hours
I	Mycoses Characteristics of fungi- morphological classification of fungi- classification of fungal infections - superficial mycoses- surface, cutaneous infections- subcutaneous mycoses- Mycetoma, Chromomycoses, Sporotrichosis, Rhinosporidiosis.	12
II	Systemic Mycoses Systemic Mycoses –Histoplasmosis, Blastomycosis, Coccidioidomycoses, Opportunistic Mycoses- <i>Cryptococcosis</i> , <i>Candida albicans</i> , Aspergillosis and Penicilliosis. Antifungal agents- Antifungal susceptibility testing- CLSI, EUCAST methods.	12
III	Protozoology Introduction to protozoa- Morphology, life cycle, pathology - <i>Entamoeba histolytica</i> , Intestinal flagellates- <i>Giardia lamblia</i> , Genital flagellate- <i>Trichomonas vaginalis</i> , Hemoflagellates- <i>Leishmania donovani</i> , Tissue flagellate- <i>Toxoplasma gondii</i> Malarial parasite- <i>Plasmodium vivax</i> and Coccidia- <i>Cryptosporidium parvum</i> .	12
IV	Helminthology Helminthology- Medically important helminths- Tapeworms- <i>Taenia solium</i> , <i>Taenia saginata</i> , Trematodes- <i>Schistosoma haematobium</i> ; <i>Fasciola hepatica</i> ; Nematodes- <i>Ascaris lumbricoides</i> , <i>Wuchereria bancrofti</i>	12
V	Laboratory Methods for fungi and Parasites Collection of specimen (Fungal infection) - wet mount, KOH and LPCB and fungal culture --Collection of specimen (parasitic infection) - Preservation and examination of stool- macroscopic and microscopic examination, Concentration methods- floatation- sedimentation techniques, duodenal contents, anal swabs, blood- thin and thick smear- staining and cerebrospinal fluid. Artificial Intelligence Diagnostic Testing – AI and Gram Stain – AI and Parasitology.	12

Text Book :

1. Subash Chandra Parija., "Textbook of Medical Parasitology protozoology and Helminthology", 2013. All India Publishers and Distributors, New Delhi.
2. Bailey and Scotts., "Diagnostic Microbiology", 2013. 13th edition, Baron and Finegold CV Mosby Publications, New York.

Reference Books

1. Ananthanarayan and Jayaram Paniker., "Textbook of Microbiology", 2020. University Press India Pvt ltd, New Delhi.
2. Talib. V.H., "Handbook of Medical Microbiology". 2015. CBS Publishers, New Delhi.
3. Rajesh Karyakarte and Ajith Damle., "Medical Parasitology", 2012. Books and Allied(P)Ltd, .New Delhi
4. Mackie and Mc catney., "Medical Microbiology No I and II". 1994. Churchill Livingstone, 14th edition, New Delhi.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU28	Course Title	Batch	2019-2020 only
		BIOINFORMATICS AND NANOTECHNOLOGY	Semester	VI
Hrs/Week:	5		Credits:	5

Course Objective

1. To develop basic ideas about the application of computers in biology.
2. To learn about the bioinformatics databases, databanks, data format and data retrieval from the online sources.
3. To impart better understanding of biological data through different bioinformatics tools.
4. To analyze the synthesis of nanoparticles.

Course Outcomes (CO)

K1	CO1	Identify the basics concepts in Bioinformatics
K2	CO2	Apply databases and recognize amino acid substitution matrices
K3	CO3	Compare different alignment methods in multiple sequence analysis.
K4	CO4	Determine the different methods in nanoparticles synthesis

Mapping of Outcomes

CO	PO	PO1	PO2	PO3	PO4
CO1		S	S	M	L
CO2		S	S	M	L
CO3		S	S	M	L
CO4		S	M	S	M

S - Strong; M-Medium; L-Low.

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19MBU28	BIOINFORMATICS AND NANOTECHNOLOGY	VI
Unit No.	Topics	Hours
I	Introduction to Bioinformatics Scope of Bioinformatics – Elementary commands and Protocols, ftp, telnet, http. Printer on information theory. Databanks – nucleotide databanks – Genbank, NCBI, EMBL, DDBJ – protein databanks – sequence databanks – PIR, SWISSPROT, TrEMBL - structural databases – PDB, SCOP, CATH.	12
II	Databases Introduction to databases – database search – Algorithms issues in database search – sequence database search – FASTA – BLAST – Amino acid substitution matrices PAM and BLOSUM. Phylogenetic alignment- Parsimony method, Distance matrix method, – connection between multiple alignment and tree construction	12
III	Alignment Methods Introduction – Strings – Edit distance two strings – string similarity local alignment -gaps – parametric sequence alignments – suboptimal alignments – multiple alignment – common multiple alignment methods- Dynamic programming, progressive alignment and iterative refinement.	12
IV	Nanostructure Classification: Classification of Nanostructures-1D, 2D and 3D nanomaterials- Nanoscale Architecture. Synthesis of Nanomaterials: Top down –ballmilling: Bottom up-co-precipitation-sol-gel-electrodeposition -using natural nanoparticles –chemical vapour deposition.	12
V	Application of Nanomaterials Nanomedicines, immune toxins, liposomes as drug carriers, gene therapy, personalized medicine, DNA computers (Information Storage & Processing capabilities), artificial life, biosensors.	12

Text Books :

1. S. Ignacimuthu., "Basic Bioinformatics", 2013. Alpha Science International, Tamil Nadu
2. K.K.Jain., "Nano Biotechnology", 2010. Horizons Biosciences, Tamil Nadu.

Reference Books

1. Dan Gusfield., "Algorithms on Strings Trees and Sequences", 2010. Cambridge University Press, London.
2. Lesk., " Introduction to Bioinformatics", 2013. Cambridge University Press, London.
3. Baxevenis, "Bioinformatics", 2006. John Wiley & Sons, New York.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU29A	Course Title	Batch	2019-2020 only
		ENTREPRENURSHIP IN MICROBIOLOGY	Semester	VI
Hrs/Week:	5		Credits:	5

Course Objective

1. To teach the skills of converting basic biology knowledge into sustainable business by providing novel/innovative solutions to the existing challenges in the field of Microbiology
2. To enhance the knowledge and entrepreneurial capabilities and competence of the life science graduates.
3. To convert their subject knowledge, skills, and ideas into a profitable and sustainable business
4. To provide an ideal interdisciplinary knowledge and to protect their products by patenting

Course Outcomes (CO)

K1	CO1	Relate the ability to discern distinct entrepreneurial traits
K2	CO2	Make use of the parameters to assess opportunities and constraints for new business ideas in biology
K3	CO3	Discover the skills for product development
K4	CO4	Compare Indian and global patents

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	L	S	M	M
CO2	M	S	M	M
CO3	S	S	M	M
CO4	M	S	M	M

S - Strong; M-Medium; L-Low.


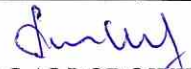


19MBU29A	ENTREPRENURSHIP IN MICROBIOLOGY	VI
Unit No.	Topics	Hours
I	Evolution of the concept of entrepreneur Entrepreneurship: concept of Entrepreneurship; development – need – role of resource, talent and spirit – process of entrepreneurship to socio-economic gains –Bioentrepreneur.	12
II	Institutions and schemes of government of India Schemes and programmes, Department of science and technology schemes, Nationalized banks – other financial institutions etc., – SFC- NSIC-SSIC-SIDBI-DIC-TAHDSCO-SID-MSME and commercial banks etc., Start-up programme by Government of India – DBT-Technology Business Incubator-TBI- BIRAC- Nidhiprayas, Association of Biotechnology Led Enterprises (ABLE)- Biotechnology Ignition Grant-(BIG)	12
III	Skills for entrepreneurs Communication skills, problem solving skills; Business plan development; Market need – market research, SWOT analysis, identify your competition. Financial plan – obtain financing for your business, insure your business, Marketing – mix-product, distribution, price, promotion, set marketing goals-Leadership skills	12
IV	Small scale entrepreneurship Biocomposting- Domestic waste, agricultural and industrial waste- vermi – composting. SCP production – mushroom cultivation. Biofertilizers and Biopesticides. Development of diagnostic and research kits (plasmid DNA isolation, serum electrophoresis, WIDAL test kits, ABO blood grouping kits)	12
V	Patenting and Open Source IPR History of patenting, characteristics of a patent, composition, subject matter and, Inventor, Infringement, cost of patent. Patents in India and other countries- Open source and commercial software-WIPO.	12

Text Book :

1. S. L Gupta., "Entrepreneurship Development", 2013. International Book house, India
2. Greene., "Entrepreneurship ideas inaction", 2011. Thomson learning, New York.

Reference Books

1. Ronald M Atlas and Richard Bartha., "Microbial Ecology", 1998. Pearson publication, Germany.
2. Anil kumar S., " Entrepreneurship Development", 2021. New Age International, India.
3. Satyanarayana U ., "Biotechnology", 2020. Books and Allied P Ltd, Kolkata, India.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU29B	Course Title	Batch	2019-2020 only
		LARGE SCALE MANUFACTURING PRACTICES	Semester	VI
Hrs/Week:	5		Credits:	5

Course Objective

1. To explain about the fermentation process
2. To gain knowledge on industrially important strain and media formulation for large scale industries
3. To summarize the types of fermentors
4. To build the knowledge on quality assurance system in industries.

Course Outcomes (CO)

K1	CO1	Classify the types of fermentation processes
K2	CO2	Identify the strain for Industrial production.
K3	CO3	Categorize the skills for design of Bioreactors
K4	CO4	Assess quality control and assurance in finished product.

Mapping of Outcomes

CO	PO	PO1	PO2	PO3	PO4
CO1		L	S	M	M
CO2		M	S	M	M
CO3		S	S	M	M
CO4		M	S	M	S

S - Strong; M-Medium; L-Low.



 Anna University, Chennai


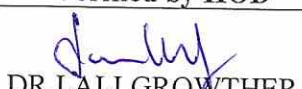
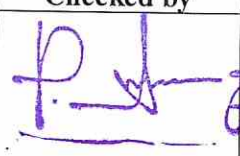

19MBU29B	LARGE SCALE MANUFACTURING PRACTICES	VI
Unit No.	Topics	Hours
I	Fermentation Definition, Historical perspective, Lay out of a typical fermentation unit - Types of fermentations - Submerged, Surface, Solid State, Dual, Batch, Continuous, Fed Batch- Screening - Primary and Secondary Screening.	12
II	Bioreactor Design Characteristics of an ideal Fermenter- Construction material used-surface treatment of material Design of a typical Batch Fermenter, Aerator and Agitator- types, Baffles, Seals and valves used, steam traps - Additional accessories and peripherals.	12
III	Upstream Process Microbes of industrial importance, Culture collection centers of industrially important microorganisms -Methods for strain improvement - Inoculum build up for Industrial fermentations - Bacteria and Fungi- Carbon sources - Cane and Beet molasses, Malt, Corn, Starch, oils, hydrocarbons, alcohols. Nitrogen sources - Corn steep liquor, Soybean meal, peanut meal Buffers Chelators Water Precursors, Inhibitors, Inducers Antifoams.	12
IV	Downstream Process Product recovery and purification - intracellular and extracellular products- cell disruption, centrifugation, filtration, flotation chromatography, flocculation, solvent extraction, precipitation, drying, crystallization - packaging and marketing	12
V	Quality assurance and Validation Concept of Good Manufacturing Practices (GMP) -Standard Operating Practices (SOP) - Quality Control and Quality Assurance (Definition, Functions and Responsibilities) - Tests Used for Quality Assurance of finished product- Sterility Testing.	12

Text Books:

1. A.H. Patel., "Industrial Microbiology", 2016. Macmillan India Publishers, New Delhi.
2. Prescott and Rehm., " Industrial Microbiology", 2004. Wiley and Sons, France.

Reference Books

1. Stanbury P T and Whitaker., "Principles of Fermentation Technology", 2016. Pergamon Press, New York.
2. Casida, L E JR., "Industrial Microbiology", 2019. New Age International Publishers, New Delhi.
3. Nduka Okafor., "Modern Industrial Microbiology and Biotechnology", 2007. CRC Press, New Delhi.

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Hindusthan College of Arts & Science,
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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU29C	Course Title		Batch
		BIOETHICS, IPR AND BIOSAFETY		Semester
Hrs/Week:	5		Credits:	5

Course Objective

1. To illustrate the ethical and social values to students.
2. To discuss the legal aspects in microbiological research.
3. To explain patentable subjects in biological research.
4. To demonstrate the guidelines and protocols of biosafety.

Course Outcomes (CO)

K1	CO1	Illustrate the ethics in biological Research
K2	CO2	Organize the ethics in usage of animal and human specimens for research
K3	CO3	Classify ideas for patenting in biological research
K4	CO4	Interpret biosafety protocols and guidelines

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	L	L	S
CO2	S	S	M	S
CO3	S	S	M	M
CO4	S	S	M	M

S - Strong; M-Medium; L-Low.

(15) marks for each outcome
 score of 40 to 45 is considered
 200 (10-12 marks)

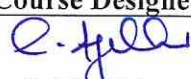

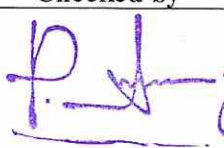
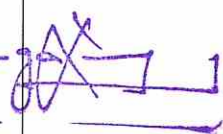
19MBU29C	BIOETHICS, IPR AND BIOSAFETY	VI
Unit No.	Topics	Hours
I	Bioethics Bioethics – Social, Legal, and Ethical issues in biotechnology, Bioethics committees Rules for the manufacture, use/import/export and storage of hazardous microorganisms/genetically engineered organisms or cells (Ministry of Environment and Forests Notification, 1989). Ethical concerns of Microbiology research and innovation.	12
II	Animal Ethics Animal ethics - Norms in India-Licensing of animal house - Ethical clearance norms for conducting studies on human subjects, IAEC Ethical considerations during research; Animal testing; xenotransplantation; embryonic and adult stem cell research; assisted reproductive technologies.	12
III	IPR and Human relations IPR – patents- other forms of IPR (Copyright - Trademark – Designs), Farmer’s rights – WTO – GATT. Patentable subjects and protection in biotechnology- The patenting of living organisms.	12
IV	Biosafety Protocols Biosafety for human health and environment. - Global scenario of transgenic microorganisms and plants. Biosafety Committee (IBC), Review Committee on Genetic Manipulation, Genetic Engineering Approval Committee (GEAC), State Biosafety Coordination Committee (SBCC), District Level Committee (DLC). Ecological risk of engineered microorganisms/plants and remedial measure.	12
V	Biosafety Guidelines Biosafety guidelines for research - Containment facilities (physical and biological) - Advantage and disadvantage of genetically modified organisms and genetically modified foods- GLP and GMP.	12

Text Books :

1. Raj mohan Joshi., “Biosafety And Bioethics”, 2006.Gyan books pvt.lmt., Bangalore.
2. Cartagena Protocol on Biosafety (2006) Ministry of Environment and Forest, Government of India, New Delhi

Reference Books

1. Beier, F.K., Crespi, R.S. and Straus, T. *Biotechnology and Patent protection-1985*. Oxford and IBH Publishing Co. NewDelhi.
2. Sasson A, *Biotechnologies and Development*, 1988. UNESCO Publications.
3. Singh K, *Intellectual Property rights on Biotechnology*, 2015. BCIL, New Delhi.
4. *Regulatory Framework for GMOs in India (2006) Ministry of Environment and Forest, Government of India, New Delhi*

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU30	Course Title	Batch:	2019-2020 only
		PRACTICAL VII- VIROLOGY, MYCOLOGY AND PARASITOLOGY	Semester:	VI
Hrs/Week:	5		Credits:	3

Course Objective

1. To impart practical knowledge on the techniques used in isolation and titration of coliphages
2. To impart practical knowledge on cultivation of fungi and observation by microscopy
3. To perform antifungal susceptibility testing
4. To observe parasites in blood smears and to interpret the results

Course Outcomes (CO)

K1	CO1	How to identify coliphages and the technique of viral cultivation
K2	CO2	Experiment with basic diagnosis in mycology to identify fungal pathogens
K3	CO3	Examine antifungal sensitivity testing
K4	CO4	Evaluate parasitic infections

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	M	S	M
CO2	S	M	S	M
CO3	S	M	L	M
CO4	S	S	M	M

S- Strong; M-Medium; L-Low.



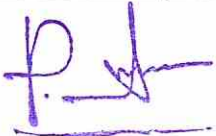
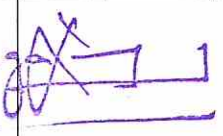
19MBU30	PRACTICAL VII - VIROLOGY, MYCOLOGY AND PARASITOLOGY	VI
LIST OF EXPERIMENTS		
1.	Isolation of coliphages from sewage	5
2.	Titration of coliphages	5
3.	Cultivation of viruses –Egg inoculation	5
4.	Identification of fungi- Lactophenol Cotton blue staining	5
5.	Slide culture technique	5
6.	Cultural characteristics of Mucor, Rhizopus, Aspergillus and Penicillium	5
7.	Antifungal susceptibility testing	6
8.	Observation of representative forms of Parasites – Entamoeba, Plasmodium, Ascaris	6
9.	Examination of stool for parasites- Iodine preparation	6
10.	Examination of stool for parasites-Concentration, floatation method.	6
11.	Blood smear examination for parasites (thick and thin smears)	6

Text Book :

N. Murugalatha, Lali Growther, J. Vimalin Hena, N. Hema Shenpagam, R. Anitha, D. Kanchana Devi, G. Rajalakshmi, Microbiological Techniques, 2013, MJP Publisher.

Reference Books

1. James G. Cappuccino, Natalie Sherman, *Microbiology: A Laboratory Manual*, 2014: Pearson.
2. D.R. Arora, Bharti Arora., *Practical Microbiology.*, 2018., CBS Publishers & Distributors.

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BACHELOR OF MICROBIOLOGY

Program Code:	MBU	Program Title: Bachelor of Microbiology		
Course Code:	19MBU31	Course Title	Batch:	2019-2020 only
		PRACTICAL VIII- BIOINFORMATICS AND NANOTECHNOLOGY	Semester:	VI
Hrs/Week:	5		Credits:	3

Course Objective

1. To impart practical knowledge on the tools used in Bioinformatics
2. To demonstrate the applications of various databases in Bioinformatics.
3. To explain the significance biological data analysis through bioinformatics tools.
4. To develop basic skills in nanoparticles synthesis.

Course Outcomes (CO)

K1	CO1	List out Bioinformatics databases
K2	CO2	Define the salient features of databases
K3	CO3	Examine similarity search and to predict ORF
K4	CO4	Determine the synthesis of Nanoparticles

Mapping of Outcomes

PO CO	PO1	PO2	PO3	PO4
CO1	S	M	S	M
CO2	S	M	S	M
CO3	S	M	L	M
CO4	S	S	M	M

S - Strong; M-Medium; L-Low.



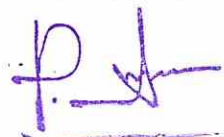
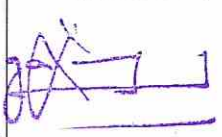
19MBU31	PRACTICAL VIII- BIOINFORMATICS AND NANOTECHNOLOGY	VI
LIST OF EXPERIMENTS		
1.	Visit NCBI, Explore and List out the salient features.	6
2.	Visit EMBL, Explore and List out the salient features	6
3.	Visit DDBJ, Explore and List out the salient features.	6
4.	Visit UniProt, Explore and List out the salient features.	6
5.	Retrieve protein sequence for tyrosinase and find out if this protein is present in <i>Agaricus bisporus</i> using BLAST P	6
6.	Similarity search- Get any two sequence in FASTA format	6
7.	Use ORF finder of NCBI to predict all possible ORF in a DNA sequence	6
8.	Use MOTIF search and PROTPARM tools	6
9.	Nanoparticle synthesis using Bacteria	6
10.	Nanoparticle synthesis using plants	6

Text Book :

N. Murugalatha, Lali Growther, J. Vimalin Hena, N. Hema Shenpagam, R. Anitha, D. Kanchana Devi, G. Rajalakshmi, Microbiological Techniques, 2013, MJP Publisher.

Reference Books

1. *James G. Cappuccino, Natalie Sherman, Microbiology: A Laboratory Manual, 2014: Pearson.*
2. *M Rajadurai, Bioinformatics: A Practical Manual., Bio-Green., 2010.*

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