

M.Sc. Microbiology

Syllabus

AFFILIATED COLLEGES

Program Code: 32L

2026 – 2027 onwards

BHARATHIAR UNIVERSITY
(A State University, Accredited with “A++” Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)
Coimbatore - 641 046, Tamil Nadu, India

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Coimbatore - 641 046, Tamil Nadu, India

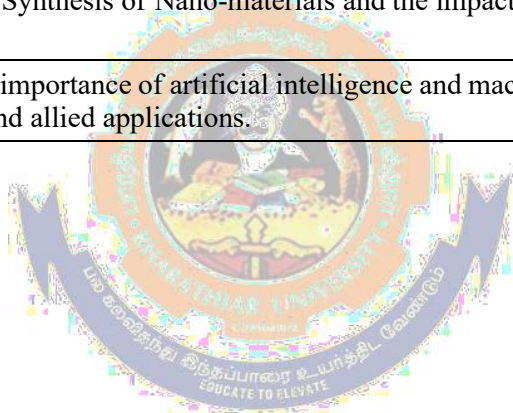
Programme Educational Objectives (PEOs)	
The M. Sc. Microbiology program describe accomplishments that graduates are expected to attain the following:	
PEO1	To provide an excellence in their microbiology subject along with research
PEO2	To expertise in the fields of clinical microbiology and also quality controller in industries
PEO3	The students shall become an industrialist and also an entrepreneur commercializing his own microbial product
PEO4	To provide the students with subject proficiency, environmental awareness, ethical codes and guidelines, along with life education for a successful professional career.



Programme Specific Objectives (PSOs)	
After the successful completion of M. Sc. Microbiology degree course, the students are able to	
PSO1	Recollect the fundamental aspects in the various branches of Microbiology, which enable them to be familiar with emerging and advanced scientific concepts in life sciences
PSO2	Implement the obtained conceptual knowledge through connecting interdisciplinary areas of Microbiology
PSO3	Evaluate the necessity and its effectiveness of scientific application towards the development of society
PSO4	Analyze the advancement in Microbiology in research aspects which lead to new inventions
PSO5	Create innovative ideas in technical areas of Microbiology, to become an industrialist, entrepreneur and a good citizen to the nation



Programme Outcomes (POs)	
On successful completion of M. Sc. Microbiology degree course, the students are able to	
PO1	Acquire knowledge on microorganisms and its significance in various fields of microbiology
PO2	Focus on innovation and entrepreneurial thinking to be successful in a rapidly changing world.
PO3	Develop knowledge in qualitative, quantitative, analytical skills and Fulfill the necessity of Life Sciences stream through clearing NET/ SLET and other competitive exams.
PO4	Conquer the novel and recent techniques to compete with the societal needs.
PO5	Impart knowledge on progressing issues and its significance on ethical thinking.
PO6	Manipulate the microbes using various molecular biology techniques for the benefit of living organisms.
PO7	Scale up production of microbial metabolites using industrially important microorganism adopting bioprocess technology
PO8	Apply bioinformatics tools for analyzing molecular biology data of Microbes
PO9	Understand the Synthesis of Nano-materials and the impact on microbiological applications.
PO10	Understand the importance of artificial intelligence and machine learning in microbiology and allied applications.



BHARATHIAR UNIVERSITY, COIMBATORE: 641 046
Revised M.Sc. MICROBIOLOGY SCHEME OF EXAMINATION
(Affiliated Colleges)

(For the students admitted during the academic year 2026-2027 Batch onwards)
To Adopt OBE Only

Study Components	Course Title	Sub. code	Inst Hrs/ Week	Exam	Max Marks			Credit
				Dur (hrs)	CIA	Univ exam	Total	
SEMESTER I								
Paper I	Fundamentals of Microbiology	13A	5	3	25	75	100	4
Paper II	Microbial Physiology and Biochemistry	13B	5	3	25	75	100	4
Paper III	Applied Biotechniques	13C	5	3	25	75	100	4
Paper IV	Environmental and Agricultural Microbiology	13D	5	3	25	75	100	4
Practical	Practical I	23P	5	-	-	-	-	-
Elective	Paper I	1EA/1EB/1EC	5	3	25	75	100	4
SEMESTER II								
Paper VI	Molecular Genetics	23A	5	3	25	75	100	4
Paper VII	Microbial Food Technology	23B	5	3	25	75	100	4
Paper VIII	Bioprocess Technology	23C	5	3	25	75	100	4
Paper IX	Gene Manipulation and Bioinformatics	23D	5	3	25	75	100	4
Practical	Practical I	23P	-	9	25	75	100	4
Practical	Practical II	23Q	5	9	25	75	100	4
Elective	Paper II	2EA/2EB/2EC	5	3	25	75	100	4
SEMESTER III								
Paper X	Immunology and Immunotechnology	33A	5	3	25	75	100	4
Paper XI	Medical Microbiology	33B	5	3	25	75	100	4
Paper XII	Biotechnology and IPR	33C	5	3	25	75	100	4
Paper XIII	Bionanotechnology	33D	5	3	25	75	100	4

Paper XIV	Biostatistics and Research Methodology	33E	5	3	25	75	100	4
Paper XV	Health and Wellness	33F	1	1	25	-	25 [#]	1
Practical	Practical III	43P	4	-	-	-	-	-
SEMESTER IV								
Elective	Paper III	4EA/4EB/4EC	4	3	25	75	100	4
Practical	Practical III	43P	5	9	25	75	100	4
Project	Project and viva-voce	47V	16*	-	50	150	200*	8
Training	Industrial training /Internship and viva- voce @	47A	-	-	-	-	25 [@]	1
Elective	Paper IV –Practical	4EPA/4EPB/4EPC	5	9	25	75	100	4
	Total						2250	90
ONLINE COURSES								
	SWAYAM – MOOC – Online Course	Non-scholastic with credits						2

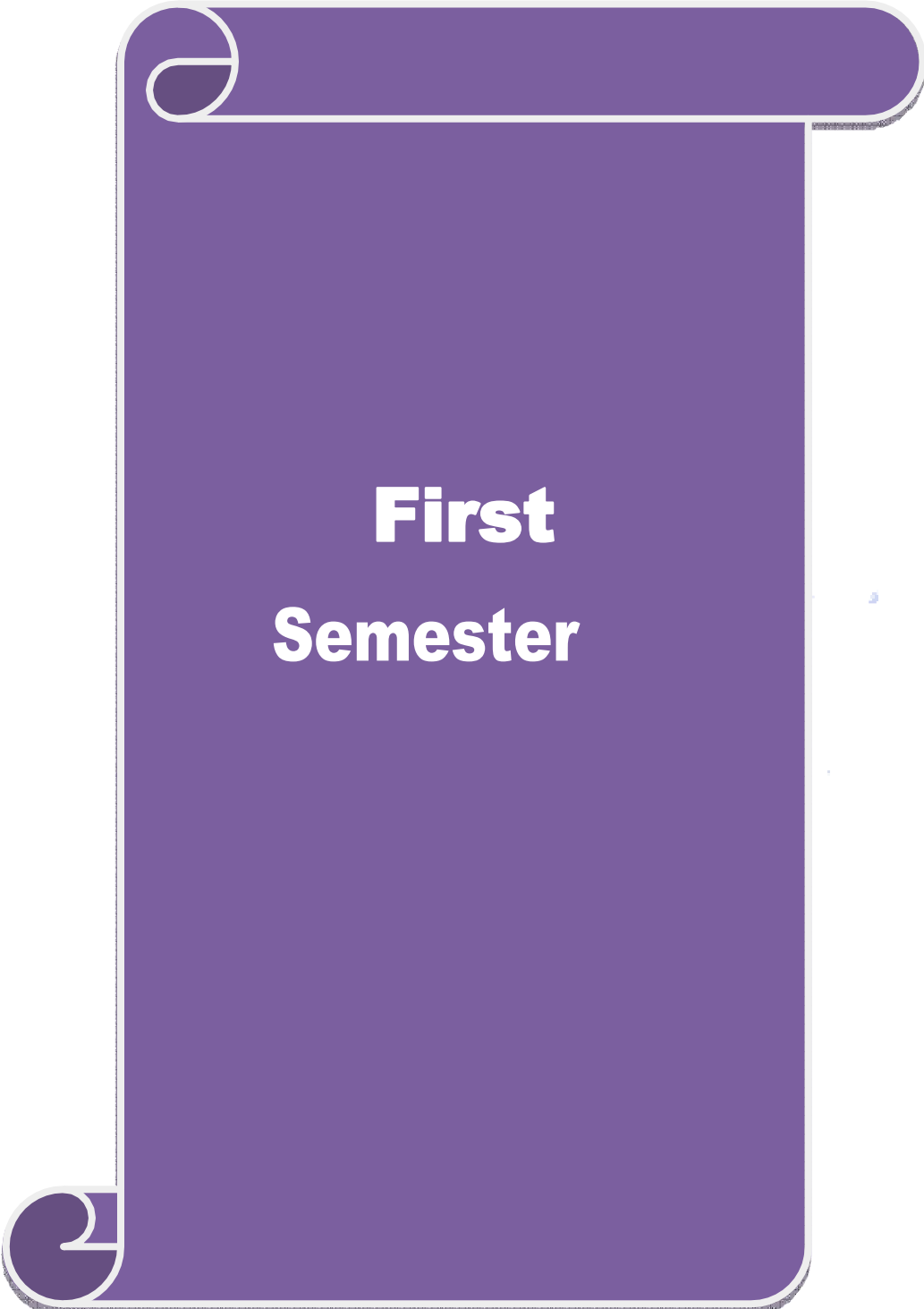
[#] No University Examination
Only Internal Evaluation

Mark Splitup

- | | |
|--|------|
| 1. Attendance | -25% |
| 2. Activity (Field trip or any other activity) | -25% |
| 3. Report | -50% |

*Project Internal - 50 and External - 150 Marks includes Dissertation, Presentation and Viva voce Marks. 16 hrs should be allotted for project guidance to the respective guides as per the University norms. 16 hrs of project guidance should be considered equivalent to 8 hrs of teaching while calculating work load of respective guides.

@Students should undergo an institutional/industrial training/ Internship relevant to any one of theory paper for a continuous period of 15 days before semester IV and submit report along with attendance certificate. Training Report – 20 Marks, Viva voce- 5 Marks. @ No University Examinations.



First Semester

Course code	13A	M. Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER I – FUNDAMENTALS OF MICROBIOLOGY	4	1	-	4
Pre-requisite		Basic Knowledge about Microbes	Syllabus Version		2020 - 2021	
Course Objective:						
To provide the students with the foundation of the microbiology including bacteriology, phycology, mycology and virology.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Acquire basics and importance of Microbiology					K1
2	Perform Microscopy, staining, and characterization of microbes					K3
3	Describe the classification of Bactria					K2
4	Know in detail the characteristic features of algal and fungal classification					K2
5	Gain insights into the important characters for classification of animal viruses					K2
K1 - Remember; K2 - Understands; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		HISTORY AND DEVELOPMENT			13 hours	
Spontaneous generation, Conflict - Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Winogradsky, Paul Ehrlich, Lederberg & Zinder, Lwoff, Arber & Smith, Temin & Baltimore, Montaigner and Galo.						
Unit:2		MICROSCOPY AND STAINING			15 hours	
Microscopy: Principle and working of Bright field, Dark field, Phase Contrast, Fluorescence, Confocal scanning microscope and Electron (TEM, SEM) microscopes. Staining: Simple, Gram, Negative, Capsule, Spore staining, Flagellar, Nuclear staining, Acid fast and Fungal staining.						
Unit:3		BACTERIAL TAXONOMY			15 hours	
Domains and kingdoms of life - Bacterial Nomenclature – Classification of bacteria by physiological, metabolic, serological and molecular methods - Bergey’s manual of systematic bacteriology with general characteristics of each division - Numerical taxonomy - 16S rRNA based classification.						
Unit:4		CLASSIFICATION OF ALGAE AND FUNGI			15 hours	
General characteristics and classification of algae (Fritsch). Structure and reproduction of <i>Chlamydomonas</i> sp. General characteristics and classification (Alexopolus) of fungi. Structure and reproduction of <i>Aspergillus niger</i> and <i>Saccharomyces cerevisiae</i> . General characteristics and classification of Protozoa. Structure and reproduction of Paramecium sp.						
Unit:5		TAXONOMY OF VIRUSES			15 hours	
General properties and Classification of Viruses. Cultivation of plant and animal viruses – Characterization and Enumeration of viruses – Quantitative assay. General properties, structure, genome replication, protein synthesis and assembly of: DNA containing plant viruses – CaMV and Gemini Virus - RNA containing plant viruses - TMV, Cowpea mosaic viruses.						

Unit:6		CONTEMPORARY ISSUES						2 hours		
Expert lectures, online seminars – webinars										
		Total Lecture hours						75 hours		
Text Book(s)										
1	Atlas, R.M., 1997. Principles of Microbiology 2nd Ed. WCB McGraw Hill Publications, New Delhi.									
2	Black, J.G., 1999. Microbiology: Principles and Explorations 4th Ed., Prentice Hall International, Inc.									
3	Presscott, L.M., Harley, J.P. and Klein, D.A., 2005. Microbiology. 6th Ed., TATA McGraw Hill, New Delhi.									
4	Alcamo E. 2001. Fundamentals of Microbiology. 6th Ed., Jones and Bartlett Publishers, New Delhi.									
5	Salle A J. 2001. Fundamentals and Principles of Bacteriology. 7th Ed., Tata MC Graw Hill, New Delhi.									
Reference Books										
1	Madigan M.T, Martinko J M, Dunlap P V and Clark. D P. 2008. Brock Biology of Microorganisms. 12th Ed. Pearson/ Prentice Hall.									
2	Hayes. W. 1968. The Genetics of Bacteria and their Viruses.									
3	Lee, R. E. 2008. Phycology. Cambridge University Press									
4	DM Knipe, PM Howley. 2007. Fields Virology. 5 th Edition. ippincott Williams & Wilkins Health									
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	http://ecoursesonline.iasri.res.in/course/view.php?id=108									
2	https://microbenotes.com/classification-of-fungi/									
3	https://www.onlinebiologynotes.com/classification-of-bacteria/									
Course Designed By: Dr. R. Vijayaraghavan										
Mapping with Programme outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	M	L	M	L	M
CO2	M	S	M	M	M	M	L	M	L	M
CO3	M	M	M	L	M	L	M	L	M	L
CO4	M	M	M	L	M	M	L	M	M	L
CO5	M	M	M	L	M	L	M	L	M	M

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

Course code	13B	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER II - MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	4	1	-	4
Pre-requisite		Fundamentals of cell organelles	Syllabus Version		2020 - 2021	
Course Objectives:						
• Introduce conceptual idea on physiology of the microorganism • Develop knowledge on the role of enzymes and its mechanism • Impart knowledge on the biosynthetic pathways to understand microbial role in beneficial and harmful effects						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the ultrastructure of prokaryotic and eukaryotic cells and apply the same in laboratory and research					K1 & K3
2	Comprehend the role of nutrients in microbial growth and their uptake mechanism, understand growth kinetics and growth influencing factors					K2
3	Understand carbohydrate metabolism, respiration and fermentation					K3
4	To categorize on the types of enzymes and their mechanism					K4
5	To prioritize the importance of biosynthesis of macromolecules					K5
K1 - Remember; K2 - Understands; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		CELL STRUCTURE AND ORGANIZATION			13 hours	
Microbial cell – Ultra structure of Prokaryotic and Eukaryotic cell – Differences between prokaryotic and eukaryotic cells – Slime layer, Capsules, Pili, Flagella - Sub-cellular organelles – structure and function - cell envelope, cytoplasm, nucleus, nuclear envelope, mitochondria, endoplasmic reticulum, Golgi Complex, ribosomes, lysosomes - Endospores, Cell membrane – Liposomes –Extremophiles - Archaeobacteria – Adaptations to extreme environments.						
Unit:2		MICROBIAL NUTRITION AND GROWTH			15 hours	
Nutritional grouping of Microorganisms - Phototrophs, Chemotrophs, Autotrophs, Heterotrophs, Lithotrophs and Organotrophs. – Uptake of nutrients by the cell – Facilitated diffusion – Active transport – Group translocation, Iron uptake - Pinocytosis and Phagocytosis - Photosynthesis - Oxygenic and Anoxygenic – Assimilation of CO ₂ - Calvin cycle - Common nutrient requirements, Growth factors – Microbial growth – Growth curve – Measurement of microbial growth. Growth kinetics – Batch, Continuous and Synchronous cultures. Factors influencing the growth of microorganisms.						
Unit:3		RESPIRATION AND FERMENTATION			15 hours	
Carbohydrate metabolism – EMP, HMP and ED pathway – Kreb’s Cycle – Glyoxylate cycle – Aerobic respiration – Substrate level and Oxidative phosphorylation – ATP generation. Lipid catabolism – β -oxidation. Anaerobic respiration – Sulphur compounds – Nitrate and Carbon -di - oxide as electron acceptors. Fermentation.						
Unit:4		ENZYMES CLASSIFICATION AND KINETICS			15 hours	
Enzymes and co-enzymes: IUBMB classification and nomenclature of enzymes, active site, Lock and key Mechanism and induced fir hypothesis, Enzyme kinetics - enzyme inhibition: Reversible – Competitive, Noncompetitive, uncompetitive, Irreversible inhibition.						

Unit:5	BIOSYNTHESIS OF MACROMOLECULES	15 hours
Protein structures, Biosynthesis – Aminoacids: Aspartic and serine families. Fatty acid synthesis, Nucleotide biosynthesis- Bioluminescence.		
Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	Microbiology. 7th edition, 2008. Prescott LM, Harley JP and Klein DA. McGraw Hill, Newyork.	
2	Caldwell. D.R. 1995. Microbial Physiology and metabolism, Wm C. Brown Publishers.	
3	Moat. A.G. and Foster. J.W. 1988. Microbial Physiology, John Wily sons. White J.D. Motteshead. D.W. Harrison S.J. Enivronmental system 2ed. 1992.	
4	Stainier R. Y. Ingraham, J.L. Wheolis, H.H. and Painter. P,R. 1986. Microbiology.	
5	Principles of Biochemistry – Lehninger, Nelson, Cox, CBS publishers.	
Reference Books		
1	Brock Biology of Microorganisms, 15th edition, 2017. Michael M. Madigan, Kelly S. Bender, Daniel H. Buckley, W Matthew Sattley, David A. Stahl, Published by Pearson	
2	The Physiology and Biochemistry of Prokaryotes, 4 th Edition, 2011. David White, James Drummond, and Clay Fuqua, Oxford University Press.	
3	Protein Structure, Stability and Folding by Kenneth P. Murphy. Published by Humana Press Inc. 2001	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.swayam2.ac.in/cec20_bt14/preview	
2	http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf	
Course Designed By: Dr. A. Vijaya Chitra		

Mapping with Programme outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	M	M	S	S	L	M
CO2	S	S	M	M	M	L	M	M	M	L
CO3	S	M	M	S	M	M	S	L	M	L
CO4	M	M	S	M	S	L	M	S	M	L
CO5	S	S	L	S	S	L	S	L	M	M

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

Course code	13C	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER III - APPLIED BIOTECHNIQUES	4	1	-	4
Pre-requisite		Aware on Bioinstrumentation	Syllabus Version		2020-2021	
Course Objectives:						
The main objectives of this course are to: Make the students know about the principle behind the instruments and to acquaint them with the fundamentals of research methods.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To help the students to identify the physical and chemical characters of macromolecules					K1
2	To facilitate the students with the principles and applications of the various techniques					K3
3	To apply their knowledge in principles and instrumentation of centrifugation					K3
4	To implement the instrumentation of chromatography					K3
5	To determine the principle and instrumentation of electrophoresis.					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		FUNDAMENTALS OF MACROMOLECULES	15 hours			
Fundamental building blocks – Atoms – Bonds and molecules. Macromolecules – Chemical nature and functions of Carbohydrate, Lipids, Proteins and Nucleic acids. Radioisotopes – Measurement, uses and safety aspects. Autoradiography, GM counters, Scintillation – Instrumentation and applications.						
Unit:2		COLORIMETRY	15 hours			
Principles, Instrumentation and Applications– Beer Lambert’s law and deviation – Analysis – Qualitative and Quantitative. Basic principles of spectrophotometry: The laws of absorption, principles and instrumentation for UV- visible and IR spectroscopy. Principles, theory and applications of spectrofluorometry, and Flame photometry, NMR, 3D structure by x- ray diffraction, ESR - Principles, Instrumentation and Applications. Analysis – Qualitative and Quantitative.						
Unit:3		CENTRIFUGATION	15 hours			
Principles – Instrumentation – Types – Methods and Factors affecting sedimentation co-efficient – Applications						
Unit:4		CHROMATOGRAPHY	15 hours			
Principles, Instrumentation, Types and Detection methods – Paper, TLC, HPLC, GC (CGMS/ LCMS), Ion-exchange, Column, Gel permeation, Chiral, Hydroxyapatite, Immuno adsorption and Affinity Chromatography – Applications.						
Unit:5		ELECTROPHORESIS	15 hours			
Principles, Instrumentation, Types. Staining and Detection methods – Isoelectrophoresis – isoelectric focusing – Applications. Mass spectrometry based methods for protein identification, MALDI-TOF, 2D gel electrophoresis.						
Unit:6		CONTEMPORARY ISSUES	2 hours			
Expert lectures, online seminars – webinars						
Total Lecture hours			75 hours			

Text Book(s)	
1	Physical Biochemistry: David Freifelder.
2	Practical Biochemistry, Boyer
Reference Books	
1	Practical Biochemistry, Keith Wilson and John Walker, 4ed . 1994
2	Foundation in Microbiology, Kathleen Talaro and Arthur Talaro, WCB Publishers. 1993.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.biopharmainstitute.com/course/GLP06
2	https://study.com/academy/topic/equipment-instrumentation-for-microbiology-labs.html
Course Designed By: Ms. N.Gunasheela	

Mapping with Programme outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	M	M	L	M
CO2	S	S	M	S	M	M	S	L	M	L
CO3	S	M	S	M	S	S	S	M	M	M
CO4	S	S	M	S	S	S	S	M	L	L
CO5	S	S	S	M	S	S	M	L	M	L

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

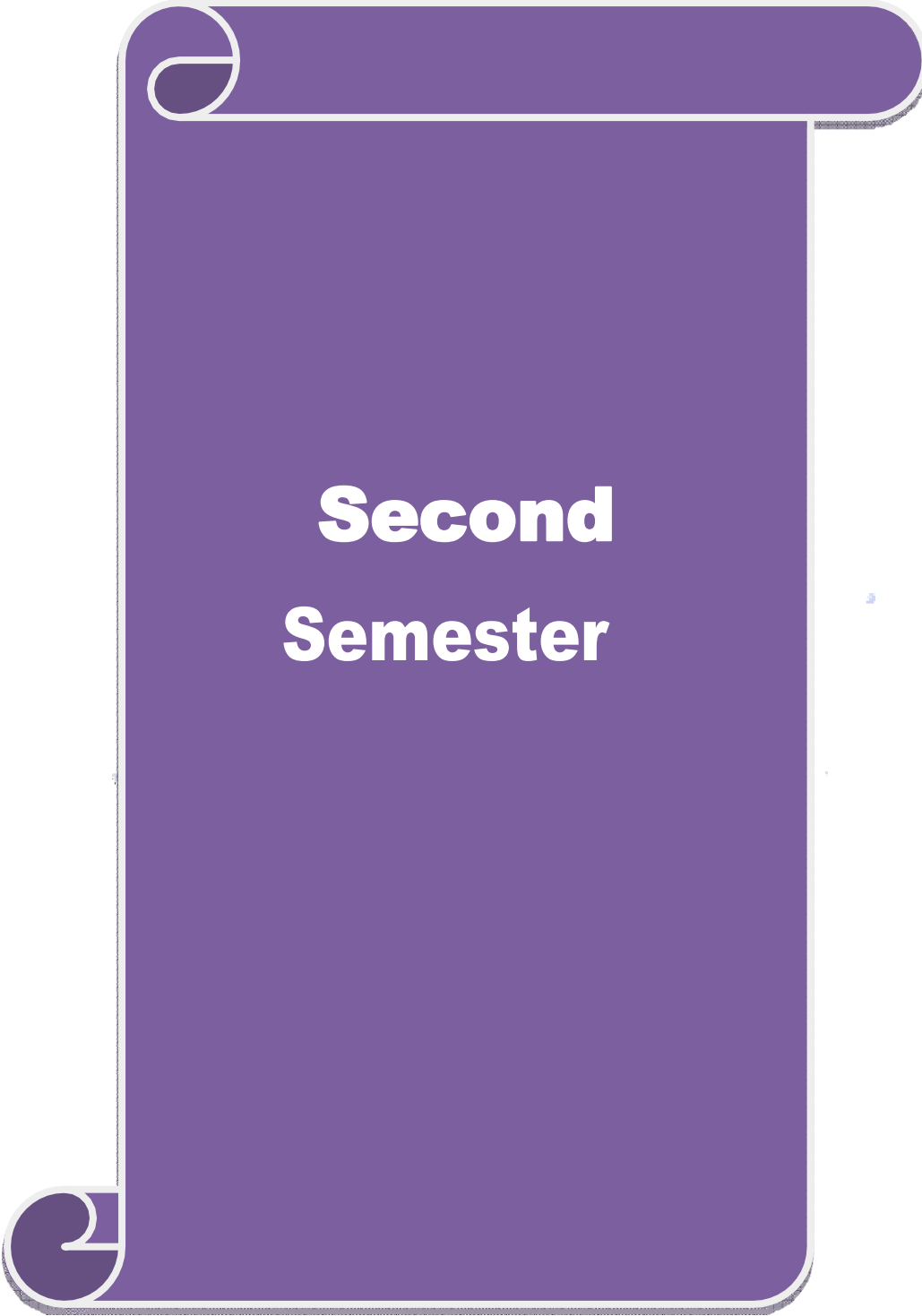


Course code	13D	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER IV- ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY	4	1	-	4
Pre-requisite		Basic knowledge about the importance of microbes in Agriculture	Syllabus Version		2020-2021	
Course Objectives:						
The main objectives of this course are to:						
• To give hands-on experience on isolation and characterization on environmental microbiology. • This paper is designed with the objective to impart hand-on experience and laboratory skills to students in the area of soil microbiology. • The practical structure is designed so that solid waste treatment.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To make the students understand the contemporary issues associated with environmental microbiology					K2
2	To understand the significance of soil microorganisms and their impact in environment					K2
3	To make the students capable of applying fundamental principle of microbiology to waste water treatment					K3
4	To facilitate the students understand microbial ecology and community development					K2
5	To facilitate understanding about analysis and treatment of hazardous and non hazardous solid wastes and treatment					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		AEROBIOLOGY	15 hours			
Microbial contamination of air-Sources of contamination-Biological indicators of air pollution. Enumeration of bacteria from air, Air sampling devices. Significance of air Microflora, Outline of Airborne diseases (Bacterial - Whooping cough, Diphtheria, Pneumonia; Fungal - Aspergillosis, Cryptococcosis; Viral – Chickenpox, Influenza, Measles), Air sanitation. Effect of Air pollution on plants and Humans.						
Unit:2		SOIL MICROBIOLOGY	15 hours			
Structure, Types, Physical and Chemical properties-Soil microbes (Types and Enumeration)-Weathering and Humus formation, Soil pollution-Sources. Biogeochemical cycling-Nitrogen, Carbon, Phosphorous, Sulphur, Iron cycles and its importance.						
Unit:3		AQUATIC MICROBIOLOGY	15 hours			
Microbiology of water (Aquatic environment-Fresh and Marine)- Water Pollution and Waterborne Pathogens. Assessment of water quality (Chemical and Microbial) Bacteriological examination of water- Indicator organisms. Waste water treatment – BOD and COD.						
Unit:4		MICROBIAL INTERACTIONS	15 hours			
Microbial interaction-among microbes, with plants, Phyllosphere, Rhizosphere, Mycorrhizae, Symbiotic and free-living nitrogen fixers (Rhizobium, Azotobacter, Azospirillum, Frankia, BGA and Azolla - Phosphate solubilizers (Phosphobacterium and Aspergillus) – Phytopathogens - Bacterial, Fungal, Viral diseases (Wilt, Blight, Canker, Mosaic) - Control measures.						

Unit:5	BIODEGRADATION OF SOLID WASTE	15 hours
Recycling of Solid wastes-Composting-Biogas, Mushroom and SCP production from Waste. Biodegradation of Complex Polymers (Cellulose, Hemicellulose, Lignin, Chitin and Pectin), Bioremediation (In-situ, Ex-situ, Intrinsic, Engineered, Solid phase, Slurry phase, Mobilization and Immobilization systems) Bioaugmentation and Biostimulation, Bioleaching (Copper and Uranium) - Degradation of recalcitrant polymers and xenobiotics eg., cellulose, lignin and lignocellulose. GMOS and Environment. Applications of GIS and RS techniques in Environmental monitoring		
Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	R. M. Atlas and R. Bartha - 1998 - Microbial Ecology - Fundamentals and Applications. Campbell. R. 1983. Microbial Ecology, 2ed	
2	Subbha Rao, M.S. 1995. Soil microorganisms and plant growth	
3	Martin Alexander, 1997. Introduction to Soil Microbiology	
4	Reiheimer. G. 1991. Aquatic Microbiology, 4ed	
Reference Books		
1	Mitchell. R. 1974. Introduction to environmental microbiology	
2	Dart. R.K. and Shettron R.J. 1980. Microbiological aspects of pollution control. 2ed	
3	Brock Biology of microorganisms 12ed, Madigan, Martinko, Dunlap, Clara, Pearson	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_ce17/preview	
2	https://www.wur.nl/en/Education-Programmes/online-education/MOOCs.htm	
Course Designed By: Ms. N.Gunasheela		

Mapping with Programme outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	M	M	L
CO2	S	S	M	S	M	M	S	M	M	M
CO3	S	M	S	M	S	S	S	L	L	M
CO4	S	S	M	S	S	L	M	M	M	L
CO5	S	S	S	M	S	M	M	M	M	M

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



Second Semester

Course code	23A	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER V - MOLECULAR GENETICS	4	1	-	4
Pre-requisite		Basic knowledge about Molecular Biology	Syllabus Version		2020-2021	
Course Objectives:						
The main objectives of this course are to: • Provide knowledge on the genetic material of microorganisms and its replication process • Impart conceptual idea about the central dogma and gene regulation • Enrich with molecular biology concepts to suit industrial needs						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concept of genetic material and its replication process					K2
2	Understand and apply the knowledge of the genetics of microorganisms and their molecular setup in gene regulation					K3
3	Understand the central dogma of the prokaryotic and eukaryotic cells, the gene regulation and operon concept					K2
4	Evaluate the role of genetic recombination in development of new microbial strains naturally and conceptual knowledge on genetic mapping					K4
5	Analyze the molecular mechanism behind mutation, DNA damage and repair and apply molecular biology aspects					K5 & K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		ORGANIZATION AND REPLICATION OF DNA			15 hours	
DNA and Replication: Mendelian principles – Discovery of DNA as genetic material - DNA structure & alternative forms of DNA. Organization of genetic material: Viruses and Bacteria-Eukaryotes: Nucleus and nucleosomes, Lamp brush chromosomes, Giant chromosomes - satellite DNA. C-value paradox. DNA replication – prokaryotes and eukaryotes - theta and Plasmid DNA replication-rolling circle models of replication - Inhibitors of replication						
Unit:2		TRANSCRIPTION			15 hours	
Transcription: Transcription in prokaryotes and eukaryotes – structures of rRNA, tRNA and mRNA, post transcriptional processes. Inhibitors of transcription. Reverse Transcription. Antisense RNA and its significance						
Unit:3		TRANSLATION AND GENE REGULATION			15 hours	
Translation: Genetic code - Deciphering of genetic code and important properties of genetic code. Translation in prokaryotes and eukaryotes - post translational processing. Inhibitors of translation. Gene Regulation - Operon models - lactose, tryptophan and arabinose operon.						
Unit:4		GENETIC RECOMBINATION AND MAPPING			15 hours	
Genetic Recombination in Bacteria: Conjugation. F+ v/s F-, Hfr+ v/s F-, F' v/s F-, Transformation, Transduction: generalized and specialized. Mobile elements in prokaryotes and eukaryotes – Insertion sequences, transposons - properties. : Linkage and genetic maps. Genetics of T4 and λ phages – Genetic mapping of T4 phage.						
Unit:5		MUTATION AND MOLECULAR MARKERS			13 hours	
Mutagenesis and DNA Repair: Mutation – spontaneous and induced mutation – Types of Mutation. Mutagenesis – Physical and Chemical - DNA damage and repair mechanism. Molecular Markers, RFLP, RAPD, AFLP and Isozyme Loci. CRISPR gene editing.						

Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	Principles of Genetics, 7th Edition, 2010. Robert H. Tamarin, McGraw Hill Education	
2	Molecular Genetics of Bacteria, 5th Edition, 2010. Jeremy W. Dale, Simon F. Park. Wiley-Blackwell Publishers	
3	Microbial Genetics, 2nd edition, 2009, John Cronan, David Freifelder, Stanly R. Maloy, Narosa Publishing House	
4	Principles of Genetics, 3rd Edition, 2003. Gardner, Simmons, Snustad, John Wiley & Sons.	
5	Essentials of Genetics, 1996. Klug, W.S. and Cummings, M.R., Prentice Hall, New Jersey	
6	Microbial Genetics, 2nd edition, 1994. Stanley R. Maloy, John E. Cronan, David Freifelder. Jones and Bartlett Publishers.	
Reference Books		
1	Genes XII, 12th Edition, 2018. Benjamin Lewin; Jocelyn E Krebs; Elliott S Goldstein; Stephen T Kilpatrick. Burlington, Massachusetts : Jones & Bartlett Learning, 2018	
2	Concepts of Genetics,12th Edition, William S. Klug, Michael R. Cummings, Charlotte A. Spencer, Michael A. Palladino, Darrell Killian, 2018	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.swayam2.ac.in/cec20_ma13/preview	
Course Designed By: Dr. A. Vijaya Chitra		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	M	S	M	L	M	M
CO2	S	S	M	M	M	S	M	M	L	M
CO3	S	M	M	S	M	S	M	M	M	M
CO4	M	M	S	M	S	S	L	M	M	M
CO5	S	S	L	S	S	S	M	L	M	M

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

Course code	23B	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER VI – MICROBIAL FOOD TECHNOLOGY	4	1	-	4
Pre-requisite		Fundamentals about food safety and role of microorganism in food processing	Syllabus Version		2020-2021	
Course Objectives:						
The main objectives of this course are to:						
• The course will enable students to understand the preservation techniques in food. • The course will teach the strategies to develop fermented and non-fermented milk products. • The student can knowledge on National and International Food Laws and Regulation						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To identify appropriate processing , preservation and packaging methods					K2
2	To understand the various causes of food deteriorations and food poisoning					K2
3	To analyze the food related hazards and HACCP method					K4
4	To evaluate the product quality and effect of processing technique					K5
5	Awareness of food laws and regulations					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		MICROBIAL FOOD SPOILAGE AND PRESERVATION			15 hours	
Food as a substrate – Incidence and types of microorganisms in food – Contamination and Spoilage of Meat, Poultry, Sea foods, Vegetables, Fruits. Principles of food preservations: Asepsis, Preservation by use of High temperature, Low temperature, Canning, Drying, Radiation and Food additives.						
Unit:2		FERMENTED FOOD AND FOOD BORNE DISEASES			15 hours	
Food poisoning – Food borne diseases- Bacterial and Non- Bacterial. Fermented foods - Meat and fishery products – Country cured hams, Dry sausages, Idly batter and Sauerkraut. Fermented milk products – Butter, Butter milk, Sour cream, Yoghurt and Cheese.						
Unit:3		ANALYSIS OF FOOD HAZARDS			15 hours	
In house Committee for quality assurance, Persons involved, Internal Microbial Quality control Policy, Quality Check at every step from collection of raw materials till it reaches the customer , Implementation of ISO standards, definitions, principles and use of HACCP in Food Industry .						
Unit:4		FOOD QUALITY AND PROCESSING TECHNIQUE			15 hours	
Indicator organisms – Direct examination – culture techniques – enumeration methods – plate – Viable & Total Count; Alternative methods – Dye reduction tests , electrical methods , ATP determination: Rapid methods, immunological methods – DNA / RNA methodology – Laboratory accreditation.						
Unit:5		FOOD LAWS AND REGULATION			15 hours	
Food laws and regulations A. National – PFA Essential Commodités Act (FPO, MPO etc.) B. International – Codex Alimentarius, ISO – 9000 series , ISO 22000 & BS 5750.C. Regulatory Agencies – WTO Consumer Protection Act - Relevance of Microbiological standards & criteria for food safety – Sampling plans – Microbiological guidelines Hygiene and sanitation in food sector General Principles of Food Hygiene, GHP for commodities, equipment, work area and						

personnel, cleaning and disinfection (Methods and agents commonly used in the hospitality industry).		
Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	James. M. Jay, 1992, Modern food microbiology 4ed	
2	Frazier, W. C. and Westhoff D.C. 1989. Food Microbiology 8 ed	
Reference Books		
1	Dubey. R.C. and Maheswari. D.K. A Textbook of Microbiology, 1999. 1ed	
2	Food Microbiology. 2nd Edition – M.R.Adams & M.O.Moss – Panima Publishers	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.swayam2.ac.in/cec20_ag13/preview	
2	https://onlinecourses.swayam2.ac.in/cec20_ag09/preview	
3	https://onlinecourses.swayam2.ac.in/cec19_ag03/preview	
4	https://www.coursera.org/courses?query=food	
Course Designed By: Ms. N.Gunasheela		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	M	M	L	M
CO2	S	S	M	S	M	M	L	M	M	L
CO3	S	M	S	S	S	M	M	L	L	M
CO4	S	S	M	S	S	M	L	M	M	M
CO5	S	S	S	M	S	L	M	M	L	M

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

Course code	23C	M.Sc MICROBIOLOGY	L	T	P	C
Core		PAPER VII - BIOPROCESS TECHNOLOGY	4	1	-	4
Pre-requisite		Aware of industrially important microbes and its products	Syllabus Version		2020-2021	
Course Objectives:						
• Make the learner competent on exploring industrially important microbes for commercially important products • Provide adequate knowledge on fermenters, its types, operation and other parameters that govern the fermentation process • Attain conceptual knowledge on different fermentation processes and provide strategies for downstream processing of microbial industrial products						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Acquire knowledge in industrial microbiology, understand the process of fermentation and its types					K2
2	Attain knowledge about the design and components of bioreactors and factors affecting the process of fermentation					K2
3	Isolate, analyze and assess industrially important microorganisms from different sources to develop new industrial microbial products					K4
4	Apply the downstream process techniques and can design suitable strategy for recovery of an product in an industry process					K3 & K6
5	Develop in to an entrepreneur with the acquired knowledge in the production of microbial products that are commercially important					K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		FERMENTATION AND ITS TYPES			13 hours	
Industrial microbiology - Types of fermentation- Solid, Submerged - Batch, Continuous, Fed batch - Component parts of fermentation process - Fermentation economics						
Unit:2		FERMENTERS			13 hours	
Fermenter design and construction, Fermenter types - Productivity, Yield coefficients, Heat production, Stirring and mixing, Gas exchange and mass transfer, Computer Applications in fermentation technology.						
Unit:3		SCREENING AND UPSTREAM PROCESSING			17 hours	
Industrially important microorganisms. Isolation - Primary and Secondary screening – Screening for - Enzymes - probiotic function – Flavour – Organic acids - use of MALDI-TOF/TOF and LC-MALDI for high throughput screening of metabolites. Preservation and improvement of industrially important strains. Upstream processing – Development of inoculums for fermentation process - Media for industrial fermentation - Formulation, Optimization - Sterilization. Stages of upstream- Growth of inoculums, Fermenter preculture and Production fermentation.						
Unit:4		DOWNSTREAM PROCESSING			15 hours	
Downstream Processing- Recovery and purification of intracellular and extracellular products- Flocculation, Flootation, Filter systems, Centrifugation, Disintegration, Chromatography, Extraction, Crystallization, Precipitation and Drying.						

Unit:5	MICROBIAL PRODUCTS	15 hours								
Microbial production of commercially important products - Organic acids (citric acid, acetic acid) - Enzymes (Amylase and Protease) - Amino acids (Lysine and Glutamic acid) - Antibiotics (Penicillin) - Vitamins (Riboflavin, cyanocobalamine and ascorbic acid). Biosynthesis of Ergot alkaloids. Microbial transformation - steroids and sterols. Non steroid compounds										
Unit:6	CONTEMPORARY ISSUES	2 hours								
Expert lectures, online seminars – webinars										
	Total Lecture hours	75 hours								
Text Book(s)										
1	Industrial Microbiology, 2 nd Edition, 2019. L.E.J.R. Casida. New Age International Publishers									
2	Cruegers Biotechnology: A Textbook of Industrial Microbiology, 3rd Edition, 2017. Wulf Crueger and Anneliese Crueger. MedTech Publishers.									
3	Microbial Biotechnology, Principles and Applications, 3rd Edition, 2013. Lee Yuan Kun, World Scientific Publishing Co. Pte. Ltd									
4	Principles of Fermentation Technology, 2nd edition, 1999. Stanbury P F, Whitaker A, Hall SJ. Butterworth Heinemann									
5	Biotechnology: A Textbook of Industrial Microbiology, 1990. Wulf Crueger and Anneliese Crueger.									
Reference Books										
1	Prescott and Dunns’ Industrial Microbiology, 4th Edition, 2004. Edited by Reed, CBS Publishers and Distributors, New Delhi									
2	Creuger and Creuger (2001). Biotechnology- A textbook of Industrial Microbiology, Sinauer Associates, Inc.									
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	https://onlinecourses.nptel.ac.in/noc20_bt21/preview									
2	https://onlinecourses.nptel.ac.in/noc20_bt25/preview									
3	https://onlinecourses.nptel.ac.in/noc20_bt26/preview									
Course Designed By: Dr. A. Vijaya Chitra										
Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	M	L	S	M	M	L
CO2	S	S	M	M	M	M	S	L	M	M
CO3	S	M	M	S	M	M	S	M	L	M
CO4	M	M	S	M	S	M	S	M	M	L
CO5	S	S	L	S	S	L	S	M	M	M

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

Course code	23D	M.Sc MICROBIOLOGY	L	T	P	C
Core		PAPER VIII – GENE MANIPULATION AND BIOINFORMATICS	5	-	-	4
Pre-requisite		Basics about Bioinformatics tools and Genetic Engineering	Syllabus Version	2020-2021		
Course Objectives:						
• To familiarize the students with the basic perceptions in genetic engineering; to explain the students to multipurpose tools and techniques employed in genetic engineering and recombinant DNA technology. • To provide knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Know the basics of gene manipulation techniques					K1
2	Understand the enzyme involved in cloning, various techniques involved in gene transformation					K2
3	Acquire knowledge on vectors and gene expressions in prokaryotes and eukaryotes					K2
4	Analyze the cloned DNA with different characterization techniques					K4
5	Impart knowledge on gene sequence using bioinformatic tools					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		BASIC TECHNIQUES			15 hours	
Isolation and purification of nucleic acids (chromosomal DNA, RNA & Plasmids) – Methods of handling and quantification of DNA and RNA. Blotting: Types of blotting – Southern, Northern and Western Blotting. Chromosome walking. Dot and Colony Blotting.						
Unit:2		RESTRICTION ENDONUCLEASES, SCREENING AND TRANSFORMATION TECHNIQUES			15 hours	
Restriction endonucleases: Types and characteristics, DNA methylases, Ligases, Adapters, Linkers and Homopolymer tailing, Genomic DNA libraries - cDNA libraries. Transformation techniques: Electroporation, microinjection, protoplast fusion and microparticle bombardment. Screening: Direct methods -Insertional inactivation, plaque phenotype - Indirect methods - Immunochemical detection, nucleic acid hybridization.						
Unit:3		VECTORS			15 hours	
Vectors: Properties, types of vectors – plasmids– host range and incompatibility, Vectors constructed based on bacteriophages (M13 & Lambda), cosmids, phasmids, phagemids and BACs, Eukaryotic vectors - Yeast vectors (YAC) – animal (retroviruses, adenoviruses) and plant vectors (Ti plasmid based vectors and caulimoviral vector), expression vectors, shuttle vectors, Expression of genes in bacteria, animal, plant, algae & fungi.						
Unit:4		CHARACTERIZATION OF CLONED DNA			15 hours	
Restriction mapping: Restriction fragment length polymorphism (RFLP), Polymerase chain reaction (PCR) - Types of PCR and their applications. DNA sequencing: Primer walking, Maxam and Gilbert method, dideoxy method, automated sequencing and micro array. Site directed mutagenesis.						
Unit:5		BIOINFORMATICS			13hours	
Introduction to Bioinformatics, Data bases and sequence alignment – DNA data bases: Genbank, EMBL – cDNA database – ESTs, NCBI: Pubmed, Entrez, BLAST – Protein data base: SWISSPROT. Similarly search tool: BLAST and FASTA.						

AA DATED: 15.05.2026

Unit:6	CONTEMPORARY ISSUES		hours
Expert lectures, online seminars – webinars			
	Total Lecture hours		50 hours
Text Book(s)			
1	Old. R. W. and Primrose S.B. 1995. Principles of Gene Manipulations – An Introduction to Genetic Engineering, 5Ed .		
2	Winnacker E.L, 1987, From Genes to Clones. – Introduction to Gene Technology. Nicholl. D.S.T, 1994. An Introduction to Genetic Engineering.		
3	Brown. T.A. 1995. Gene Cloning.		
4	Pinler. A. 1993. Genetic engineering of microorganisms		
5	Lesk, A M.2002. Introduction to Bioinformatics. Indian Ed. Oxford University Press.		
Reference Books			
1	Protein Structure, Stability and Folding by Kenneth P. Murphy. Published by Humana PressInc. 2001		
2	Protein Engineering Principles and Practice by Jeffrey L. Cleland and Charles S. Craik. Published by Wiley-Liss Inc., 1996.		
3	Protein Engineering and Design by Paul R. Carey. Published by Academic Press Inc., 1996.		
4	Andreas D B. and Francis Outlette B F. 2001. Bioinformatics – a practical guide to the analysis of genes and proteins. 2 nd Ed. Wiley Interscience, John Wiley and Sons, Inc. Publication, New York.		
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]			
1	https://www.my-mooc.com/en/categorie/bioinformatics		
2	https://www.coursera.org/specializations/bioinformatics		
3	https://nptel.ac.in/courses/102/103/102103013/		
Course Designed By: Dr. R. Vijayaraghavan			

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	L	S	M	S	M	L
CO2	M	L	M	L	M	S	M	S	M	L
CO3	S	M	M	S	M	S	M	S	L	L
CO4	M	S	S	M	M	S	L	S	M	M
CO5	S	S	S	M	S	S	M	S	L	L

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

Course code	23P	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PRACTICAL I		-	5	4
Pre-requisite		Basic knowledge about microbial culture Techniques	Syllabus Version		2020-2021	
Course Objectives:						
• Enhance the learner on practical approaches of microbiological techniques						
• Provide skillful training in microbial identification through microscopic observation and biochemical test						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To impart the awareness of elemental principles and techniques in Microbiology					K1
2	To acquire knowledge on culturing of microorganisms.					K2
3	To study the isolation process and quantification of microorganisms.					K2
4	To enable the students to identify microorganisms and characterise them biochemically.					K4
5	To assess the growth kinetics and the study basis of anaerobic culture techniques.					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
1. Sterility control test						
2. Media preparation – Liquid and Solid media, Agar deep, slant and plate.						
3. Pure culture techniques – Streak plate, pour plate, spread plate, decimal dilution.						
4. Micrometry – measurement of microorganisms.						
5. Motility determination- Hanging drop and soft agar inoculation.						
6. Enumeration of microorganisms from soil: Bacteria, Fungi and Actinomycetes.						
7. Direct Microscopic observation of fungal spores, mycelium and and yeast						
8. Staining: Smear fixation, simple, Gram, acid fast, spore, capsule and negative.						
9. Growth curve: Direct microscopic (Haemocytometer, Viable count)						
10. Effect of various intrinsic factors on the growth of bacterium and fungi – pH, Temperature, Osmotic pressure.						
11. Anaerobic culture techniques; RCM, Mc Intosh Fildes anaerobic jar, Wright’s tube method.						
12. Phenol Co-efficient test.						
13. IMViC test						
14. Hydrogen sulphide test						
15. Oxidase test						
16. Calalase test						
17. Urease test						
18. Nitrate reduction test						
19. Polymer degradation – Starch, Gelatin, Casein.						

20. Carbohydrate fermentation.		
21. Morphology of Algae		
	Total Practical hours	75 hours
Text Book(s)		
1	Microbiology: A Laboratory Manual, 11th Edition, 2017. James G. Cappuccino and Chad T. Welsh , Pearson	
2	Laboratory Exercises in Microbiology, Fifth Edition, 2002. Harley–Prescott. The McGraw–Hill Companies.	
Reference Books		
1	Microbiology A Laboratory Manual, 10 th Edition, 2014. James G. Cappuccino and Natalie Sherman, Pearson	
2	Microbiological Methods,8 th Edition, 2004. Collins and Lyne. Arnold Publishers.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://microbenotes.com/category/biochemical-test-of-bacteria/	
2	https://www.uwyo.edu/molb2210_lab/info/biochemical_tests.htm	
3	https://www.biologydiscussion.com/micrometry/micrometry-meaning-and-types-with-diagram-biology/56994	
4	https://nabl-india.org/	
Course Designed By: Dr. A. Vijaya Chitra		

Mapping with Programme outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	S	L	M	M	M
CO2	S	S	M	M	M	S	M	L	M	L
CO3	S	M	S	S	M	M	S	L	L	M
CO4	M	S	S	M	S	S	M	M	M	M
CO5	S	S	M	S	S	M	M	M	L	M

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

Course code	23Q	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PRACTICAL II	-	-	5	4
Pre-requisite		Fundamentals of Microbial Techniques	Syllabus Version		2020-2021	
Course Objectives:						
- Impart knowledge on microbial analysis of environmental samples and bioremediation - Provide expertise training in development of industrially important microbial products - Enhance the learner skill in agricultural microbiology						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To expertise in the production of commercially important microbial products					K1
2	To isolate and identify the microorganisms having agricultural importance					K3
3	To assess the quality of drinking water from sewage contamination					K4
4	To acquire knowledge on selection of microorganism for bioremediation					K5
5	To expertise in molecular techniques					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
1.Wine production – sugar estimation						
2. Organic acid production – Citric acid – Solid state and submerged fermentation.						
3.Isolation of antibiotic producing organisms and determination of antimicrobial spectrum of isolates						
4. Production of Extra cellular enzymes – Protease by submerged fermentation – Cellulase by solid state fermentation.						
5.Isolation of nitrogen fixers – free living, symbiotic, ammonification, nitrification, denitrification.						
6. Isolation of Phosphate solubilizers.						
7. Isolation of Coliphage.						
8. Microbial decolourisation of textile dyes.						
9. Isolation of mutants: Auxotrophic and Antibiotic resistant mutants.						
10. Isolation of Plasmids and chromosomal DNA from microbes.						
11. Size determination and fractionation of nucleic acids and proteins – Agarose gel electrophoresis, SDS – PAGE.						
		Total Lecture hours			75 hours	
Text Book(s)						
1	Microbiology: A Laboratory Manual, 11th Edition, 2017. James G. Cappuccino and Chad T. Welsh , Pearson					
2	Laboratory Exercises in Microbiology, Fifth Edition, 2002. Harley–Prescott. The McGraw–Hill Companies.					
Reference Books						
1	Microbiology A Laboratory Manual, 10 th Edition, 2014. James G. Cappuccino and Natalie Sherman, Pearson					
2	Microbiological Methods,8 th Edition, 2004. Collins and Lyne. Arnold Publishers.					

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.mdpi.com/2076-3417/10/8/2958/htm
2	https://www.biotechnologynotes.com/microbial-biotechnology/isolation-of-coliphages-from-sewage-microbial-biotechnology/1324
3	https://www.frontiersin.org/articles/10.3389/fpls.2015.01225/full
4	https://nabl-india.org/
Course Designed By: Dr. A. Vijaya Chitra	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	M	S	S	M	L	M
CO2	S	S	M	M	M	S	S	M	M	M
CO3	S	M	M	S	M	S	S	M	L	L
CO4	M	M	S	M	S	S	S	L	M	L
CO5	S	S	L	S	S	S	S	M	L	M

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





Third Semester

Course code	33A	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER IX- IMMUNOLOGY & IMMUNOTECHNOLOGY	5	-	-	4
Pre-requisite		Basic Knowledge about immune system	Syllabus Version		2020-2021	
Course Objectives:						
The main objectives of this course are to: • Provide the basic concepts of immunology and organization of the immune system • Impart knowledge on antigen and antibody interactions and immunological techniques • To make the learner understand the concepts of hypersensitivity, transplantation of organs and autoimmune disorders						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To recall the history and the development of immunology.					K1
2	To understand the structure, properties and functions of antigen and antibody.					K2
3	Apply the immunological techniques to understand the antigen antibody interactions and for diagnosis					K4
4	To explain the role of MHC and hypersensitivity in immune system and discuss about the immunity against various pathogens.					K3
5	To understand the role of HLA in transplantation, immunodeficiency disorders and role of vaccines in immune system.					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		INTRODUCTION TO IMMUNOLOGY			15 hours	
Historical background and scope of immunology, Immunohaematology -ABO and Rh factor. Cells and organs of immune system. Defence mechanisms of human body: Primary, Secondary and tertiary line. Types of immunity - HI and CMI						
Unit:2		ANTIGENS AND ANTIBODIES			13 hours	
Antigens - properties, Epitopes, haptens, adjuvant, cross reactivity. Antibodies - properties, structure and isotypes. Diversity and specificity						
Unit:3		ANTIGEN AND ANTIBODY INTERACTIONS			15 hours	
Serology - Introduction and classification of antigens and antibody reactions - Agglutination and precipitation reaction. Strength of antigen and antibody bindings - affinity & avidity. Monoclonal antibodies and their applications. Complement pathway and complement fixation reaction. Immunofluorescence RIA, RAST, ELISA and Flowcytometry.						
Unit:4		MAJOR HISTOCOMPATIBILITY COMPLEX AND HYPERSENSITIVITY			15 hours	
MHC antigens - types and functions. Response of B Cell to antigens. T cell products. Immunity to infectious diseases - Viral, bacterial and protozoan. Hyper sensitivity reactions.						
Unit:5		TRANSPLANTATION IMMUNOLOGY AND VACCINES			15 hours	
Transplantation immunology - Tissue transplantation and grafting. Mechanism of graft acceptance and rejection. HLA typing Tumor immunology. Immunodeficiency diseases: Primary immunodeficiency disorders: severe combined immunodeficiency (SCID disorders) and Secondary immunodeficiency disorders: AIDS, cancers of the immune system, leukemia, viral hepatitis - auto immunity: mechanism, types: Rheumatoid arthritis, Systemic lupus erythematosus, Multiple sclerosis and myasthenia gravis. Vaccines - Types and vaccination methods.						

Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	Coleman, R.M. , Lourbard, M.F and Sicard, R.E., 1992. Fundamental immunology, 2nd edition	
2	Kuby, J. 1997. Immunology, W.H Freeman and co., New York.	
3	Roitt, I.M. 1988. Essential of Immunology, Black Well Scientific Publishers.	
4	Tizard, R.I. 1983. Immunology - An introduction , Saunder's College publishers Philadelphia.	
5	Roitt's Essential Immunology. Wiley-Blackwell. 12th Edition	
Reference Books		
1	Black S., Symour, Disinfection, Sterilization and Preservation,Philadelphia, London	
2	Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York, 2001.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_bt43/preview	
Course Designed By: Dr. A. Vijaya Chitra		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	M	M	M	M	L	M
CO2	S	S	M	M	M	M	M	M	M	M
CO3	S	M	M	S	M	M	L	M	L	L
CO4	M	M	S	M	S	L	M	M	M	L
CO5	S	S	L	S	S	M	M	M	L	M

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

Course code	33B	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER X - MEDICAL MICROBIOLOGY	4	1	-	4
Pre-requisite		Basic Knowledge on microbial pathogens and its diagnosis	Syllabus Version		2020-2021	
Course Objectives: The main objectives of this course are to:						
- To introduce basic principles and application relevance of clinical disease for students who are in preparation for physicians. - The course will provide the conceptual basis for understanding pathogenic microorganisms and particularly address the fundamental mechanisms of their pathogenicity. - It will also provide opportunities for a student to develop diagnostic skills in microbiology						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To acquire knowledge on the basis of infectious diseases, diagnosis, examination of the clinical sample					K1
2	To understand the morphology, pathogenesis and lab diagnosis of pathogenic bacteria					K2
3	To apply the new approaches in lab diagnosis of mycosis infections.					K3
4	To analyse the life cycle, pathogenicity and lab diagnosis of parasitic infections					K4
5	To understand the general properties, pathogenesis and lab diagnosis of viral infections					K2
K1 - Remember; K2 - Understands; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		BASICS OF INFECTIOUS DISEASE			15 hours	
Milestones in medical microbiology - Infection: Definition and Types - Infectious Diseases process – Diagnosis – Process of sample collection, transport, examinations and discarding of clinical specimens. Antibigram and serological test. Virulence factors of bacteria – Host parasite relationship.						
Unit:2		MEDICAL BACTERIOLOGY			15 hours	
Gram positive organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Pneumococcus</i> , <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> , <i>Mycobacterium tuberculosis</i> , <i>Mycobacterium leprae</i> . Spirochaetes – <i>Treponema pallidum</i> . Gram negative organisms:- Morphology, cultural characteristics, pathogenicity and laboratory diagnosis 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>Bordetella pertussis</i> , <i>Neisseria gonorrhoeae</i> and <i>Neisseria meningitidis</i> .						
Unit:3		MEDICAL MYCOLOGY			15 hours	
Mycology: General properties and approaches to laboratory diagnosis. Mycosis – Superficial, Subcutaneous and Systemic infections – Cryptococcosis, Madura mycosis, Histoplasmosis, <i>Candida albicans</i> , Aspergillosis and Blastomycosis.						
Unit:4		MEDICAL PARASITOLOGY			15 hours	
Parasitology: Life cycle, Pathogenicity and laboratory diagnosis of <i>Entamoeba histolytica</i> , <i>Trichomonas vaginalis</i> , <i>Plasmodium vivax</i> , <i>Leishmania donovani</i> , <i>Taenia solium</i> , <i>Ascaris lumbricoides</i> , <i>Enterobius vermicularis</i> and <i>Wucheraria bancrofti</i> .						
Unit:5		MEDICAL VIROLOGY			15 hours	

Virology: General properties, structure, genome replication, protein synthesis and assembly, pathogenesis and laboratory diagnosis of: DNA containing animal viruses- Adeno viruses, Herpes viruses-type-I and type-II, Pox viruses – Variola virus. RNA containing animal viruses: Picorna virus, Rhabdo virus, Hepatitis viruses -A, B and C, Orthomyxo virus – Influenza H1N1, Paramyxovirus, Retroviruses - HIV and Rubella virus. Arbo virus – Dengue virus, Ebola virus, Prions.		
Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	Essentials of Diagnostic Microbiology – Lisa Anne Shimeld, Anne T. Rodgers	
2	Textbook of Microbiology – Ananthanarayanan and Jayaram Panicker	
3	Textbook of Medical Parasitology – Subash. C. Parija	
4	Medical Mycology – Jagadesh Chander	
5	Luria. S.E. Darnall. J.E. Baltimore. D. and Compare. A. 1978. General Virology, 3ed.	
Reference Books		
1	Laboratory Manual in Microbiology-T. Sundararaj	
2	Freidfelder ,D. 1995. Microbial genetics	
3	Medical Microbiology - Geo. F. Brooks. S	
4	Hayes. W. 1968. The Genetics of Bacteria and their Viruses	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.coursera.org/courses?query=microbiology	
2	https://www.classcentral.com/course/canvas-network-intro-to-medical-microbiology-1-bacteriology-12514	
3	https://www.classcentral.com/tag/microbiology	
Course Designed By: Ms. N.Gunasheela		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	M	M	L	L
CO2	S	S	M	S	M	M	L	L	M	L
CO3	S	M	S	M	S	M	M	M	L	M
CO4	S	S	S	S	M	L	M	L	M	L
CO5	S	S	S	S	M	M	M	L	M	L

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

Course code	33C	M.Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER XI - BIOTECHNOLOGY & IPR	5	-	-	4
Pre-requisite		Basic knowledge about the intellectual Property rights in Biotechnology	Syllabus Version		2020-21	
Course Objectives:						
The main objectives of this course are to: - To develop the knowledge of gene expression and microbial production of recombinant molecules - To describe the new developments in plant & Animal biotechnology - To provide basic understanding on Intellectual Property Rights (IPR)						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To recollect the basic concepts in gene manipulation techniques					K1
2	To understand the basics of microbial production of therapeutic agents and various types of modern vaccines.					K2
3	To acquire the knowledge of microbial products which are commercially important					K3
4	To ascertain the methodologies in Plant and Animal Biotechnology process					K3
5	To popularize the basic concepts of patents and the importance of related components					K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1	MICROBIAL PRODUCTION OF RECOMBINANT THERAPEUTIC PRODUCTS					15 hours
Microbial Production of Therapeutic Agents and Vaccines: Emergence of molecular biotechnology – Commercialization – concerns and consequences - Pharmaceuticals - interferon's and growth hormones, enzymes: DNase I and alginate lyase, Monoclonal antibodies - HIV therapeutic agents. Subunit vaccines: Herpes simplex virus, Foot and mouth disease virus, TB, Peptide vaccines – genetic immunisation – attenuation through recombinant DNA technology, vector vaccines						
Unit:2	MICROBIAL PRODUCTION OF RECOMBINANT PRODUCTS					13 hours
Synthesis of Commercial Products by Recombinant Microorganisms: Restriction endonucleases: PstI, Small biological molecules: Indigo, Antibiotics: Synthesis of Novel antibiotics. Biopolymers: Xanthan gum, Melanin, byssal adhesive, rubber and PHA.						
Unit:3	PLANT BIOTECHNOLOGY					17 hours
Plant Biotechnology: Plant growth promoting bacteria (PGPR) – genetic engineering of nitrogenase gene cluster, hydrogenase and Nodulation. Biocontrol of pathogens: Siderophores, antibiotics and enzymes. Plant transformation with Ti plasmid, Ti plasmid derived vectorsystems, physical method of gene transfer, developing plant strains by genetic engineering -insect, virus and herbicide resistant plants. Plant as bioreactors. Microbial insecticides: Insecticidal toxin of BT - genetic engineering of BT toxin genes – Baculovirus.						

SCAA Dated: 15.05.2024

Unit:4										
Animal Biotechnology: Transgenic mice methodology – Retroviral vector, DNA microinjection, Engineered embryonic stem cell method. Applications – transgenic disease models – Alzheimer disease. Transgenic cattle and sheep. Human gene therapy – in vivo and ex vivo gene therapy – gene delivery system. Molecular diagnostics for genetic diseases.										
Unit:5	INTELLECTUAL PROPERTY RIGHTS (IPR)								13 hours	
Intellectual Property Rights (IPR): Patents - copy right and neighboring rights, patents for invention, trademarks, trade names - Conditions for patentability - Drafting and filing a patent application, infringement, copyright and development, exploitation of patented invention. Indian patent laws. Regulating the use of biotechnology: recombinant DNA Technology, food and agricultural ingredients, - patenting biotechnology inventions - Bio safety and Bioethics.										
Unit:6	CONTEMPORARY ISSUES								2 hours	
Expert lectures, online seminars – webinars										
Total Lecture hours								75 hours		
Text Book(s)										
1	Glick, B. R and Pasternak, J.J. 2003. Molecular Biotechnology – Principles and Applications of Recombinant DNA. ASM Press, Washington D.C.									
2	Chawla, H.S. Introduction to Intellectual Property Rights. 2020 edition. Oxford & IBH Publications.									
3	U. Satyanarayana. Biotechnology. 2010.Books and Allied (P) Ltd, 8/1 Chintomoni Das Lane, Kolkata 700009. India									
Reference Books										
1	Old, R.W. and Primrose, S.B. 1995. Principles of Gene Manipulation - An Introduction to Genetic Engineering 5th Ed. Blackwell Scientific Publications, London.									
2	Brown T A., 2001. Gene cloning and DNA analysis introduction. 4th Ed. Blackwell Science Ltd., London.									
3	Winnacker E.L., 2003. From Genes to Clones – Introduction to Gene Technology. First Indian reprint, PANIAMA publishing Co-operation, New Delhi.									
4	Watson, J. D., Gillman, M., Iknowski, J and Zollar, M 2001. Recombinant DNA. 2nd Ed. Scientific American Books, WH freeman and Company, New York.									
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	https://swayamprabha.gov.in/index.php/program/archive/9									
2	https://ipindia.gov.in/									
3	https://www.wipo.int/									
4	https://onlinecourses.nptel.ac.in/noc20_bt21/preview									
5	https://onlinecourses.nptel.ac.in/noc20_bt32/preview									
Course Designed By: Dr.T.Savitha										
Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	M	S	S	S	S	L	M	L
CO2	S	M	L	L	M	S	S	M	M	M
CO3	L	M	S	L	S	S	S	L	M	L
CO4	M	S	M	S	L	S	S	M	M	L
CO5	S	L	L	M	M	S	S	M	M	L

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

Course code	33D	M. Sc. MICROBIOLOGY	L	T	P	C
Core		PAPER XII – BIONANOTECHNOLOGY	4	1	-	4
Pre-requisite		Basic knowledge about Nano-materials	Syllabus Version		2020-2021	
Course Objectives:						
- To make the students acquire an understanding the Bio-nanoscience and Applications. - To help them understand in broad outline of Bio-nanoscience and Nanotechnology.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	List out and study nanostructures and bio inspired nanomaterials.					K1
2	Discuss various methods in the process of nanoparticle synthesis.					K2
3	Demonstrate physiochemical properties of materials at nano scale level.					K3
4	Integrate various instruments involved in characterizing nanomaterials.					K4
5	Prioritize the range of biological applications of nanoparticles.					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		INTRODUCTION			13 hours	
Definition: Nanotechnology - Nanobiotechnology - Nanomaterial - Nanocomposites -Classification of nanostructures – Top down and Bottom Up approach - Quantum dots - Bio-inspired nanomaterials.						
Unit:2		SYNTHESIS METHODS OF NANOMATERIALS			15 hours	
Physical synthesis - Ball Milling - Thermal evaporation - Chemical synthesis - Solgel Process - Hydro thermal Synthesis - Biological Synthesis – Plant, Microbial compound based synthesis.						
Unit:3		PROPERTIES OF NANOMATERIALS			15 hours	
Physical properties - Optical, Magnetic, Surface Plasmon resonance - Electrochemical Properties of Nanoscale Materials, Intra-molecular bonding, Inter-molecular bonding, Nanocatalysis, Self-assembly – DNA, Protein.						
Unit:4		CHARACTERIZATION METHODS			15 hours	
X-ray diffraction (XRD) - Dynamic Light Scattering (DLS). Electron microscopes: Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM) -UV - Visible Spectrophotometer - Fourier Transform InfraRed Spectrometer (FTIR).						
Unit:5		APPLICATIONS OF NANOPARTICLES			15 hours	
Drug delivery – Nanoparticles in cancer therapy, Biosensors - DNA Microarrays - Cell Biochips - Nanoparticles for Bioimaging - Military applications of Nanotechnology - Nanomaterials for food Applications - Toxicity of Nanoparticles - Future Perspectives.						
Unit:6		CONTEMPORARY ISSUES			2 hours	
Expert lectures, online seminars – webinars						
		Total Lecture hours			75 hours	
Text Book(s)						
1	Pradeep .T. 2008. Nano: The Essentials: Understanding Nanoscience and Nanotechnology. Tata McGraw-Hill Publishing Company Limited, New Delhi.					
2	Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan. 2005. Nanoscale Science and Technology. John Wiley & Sons, Ltd., UK.					

3	Guozhong Gao. 2004. Nanostructures & Nanomaterials: Synthesis, Properties & Applications. Imperial College Press.
4	Richard C Brundle, Charles A. Evans Jr., Shaun Wilson. 1992. Encyclopedia of Materials Characterization. Butterworth-Heinemann Publishers.
Reference Books	
1	Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse. 2005. Nanotechnology: Basic Science and Emerging Technologies. Overseas Press.
2	Vladimir P Torchilin. 2006. Nanoparticles as Drug carriers. Imperial College Press, USA.
3	Christ M. Niemeyer, Chad A. Mirkin. 2004. Nanobiotechnology: Concepts, Applications and Perspectives. Wiley-VCH, Weinheim.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/118/104/118104008/
2	https://www.my-mooc.com/en/categorie/nanotechnology
3	https://www.coursera.org/courses?query=nanotechnology
Course Designed By: Dr. R. Vijayaraghavan	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	L	M	L	S	S	L
CO2	M	L	M	L	M	M	M	S	S	M
CO3	S	M	M	S	M	M	L	S	S	M
CO4	M	S	S	M	M	M	M	S	S	L
CO5	S	S	S	M	S	M	M	S	S	L

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

Course code	33E	M.Sc MICROBIOLOGY	L	T	P	C
Core		PAPER XIV – BIOSTATISTICS AND RESEARCH METHODOLOGY	5	-	-	4
Pre-requisite		Basic knowledge about Statistics & Research	Syllabus Version		2020-2021	
Course Objectives:						
• Make the learner competent on biostatistics analysis • Provide adequate knowledge on measures of central tendency, correlation,T-test and ANOVA • Provide awareness on research ethics and to inculcate research insight in the minds of the learner						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To recall the scope of biostatistics.					K2
2	To apply their knowledge in measure of central tendency.					K3
3	To understand the correlation of different statistical methods.					K4
4	To analyse the basic ideas of various significance test.					K4
5	To explore the different aspects of research ethics.					K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		INTRODUCTION TO BIOSTATISTICS			15 hours	
Definition – Scope of Biostatistics, Probability analysis, Variables in Biology, Collection, Classification and Tabulation of data. Graphical and diagrammatical representation –Scale diagram - Histogram- frequency curve.						
Unit:2		MEASURES OF CENTRAL TENDENCY			15 hours	
Measures of central tendency - Arithmetic mean, Median, Mode. Calculation of Mean, median, Mode in series of individual observations, discrete series, continuous, open end classes, measure of dispersion, standard deviation, standard error. Variance, Range and Percentile						
Unit:3		CORRELATION			13 hours	
Simple correlation coefficient, correlation regression- simple and linear. Skewness						
Unit:4		T –TEST and ANOVA			15 hours	
Basic ideas of significant test-Hypothesis testing, Level of significant test, test based on studies-t-test- chi square, Goodness of fit. ANOVA						
Unit:5		RESEARCH METHODOLOGY			15 hours	
Plagiarism and research ethics. Selection of research problem – Formulation of research objectives - project design - review of literature writing - Sources of data collection for biosciences research - processing of data - presentation of data – editing – preparation of master’s thesis. Presenting the research findings in open defense.						
Unit:6		CONTEMPORARY ISSUES			2 hours	
Expert lectures, online seminars – webinars						
			Total Lecture hours		75 hours	

Text Book(s)	
1	S.P. Gupta-Statistical Methods
2	Palanisamy and Manoharan-Statistical methods of Biology
3	Khan and Khan- Fundamentals of Biostatistics
4	Kothari-Research Methodology
Reference Books	
1	Practical Statistics: R S N Pillai and Bhagavathi
2	Fundamentals of Statistics: D. N. Elhance, Veena Elhance and B. M. Aggarwal
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc20_bt28/preview
2	https://onlinecourses.swayam2.ac.in/cec20_mg13/preview
3	https://onlinecourses.swayam2.ac.in/cec20_bt23/preview
Course Designed By: Dr. T. Viswanathan	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	L	M	M	L	M	M	L	M
CO2	L	L	L	L	L	M	L	S	M	L
CO3	M	S	M	L	M	L	M	S	L	M
CO4	M	L	M	M	S	M	L	S	M	L
CO5	L	L	M	L	M	L	M	M	L	L

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



Course code	33F	M.Sc MICROBIOLOGY	L	T	P	C
Core		PAPER XV – HEALTH AND WELLNESS	1	-	-	1
Pre-requisite		-	Syllabus Version		2025-2026	
Course Objectives:						
The main objective of this course is to • Teaching the elements of physical, mental, emotional, social, intellectual, environmental well-being which are essential for overall development of an individual. • Addresses the dangers of substance abuse and online risks to promote emotional and mental health.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To demonstrate proficiency in sports training and physical fitness practices.					K2
2	To improve their mental and emotional well-being, fostering a positive outlook on health and life.					K3
3	To develop competence and commitment as professionals in the field of health and wellness.					K4
4	To create awareness on drug addiction and its ill effects.					K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		INTRODUCTION TO HOLISTIC WELL-BEING			3 hours	
Introduction to Holistic Well-being- Wellness Wheel Exercise - Breaking Bad Habits						
Unit:2		PHYSICAL WELL-BEING			3 hours	
Physical Well-being- Fitness - Nutrition - Yoga - Meditation - Brain health - Healthy lungs - Hygiene and Grooming						
Unit:3		EMOTIONAL WELL-BEING			2 hours	
Emotional Well-being – Stress Management-Importance of saying ‘No’ for their Physical and Mental well-being- Body Positivity and self-acceptance - Practicing Gratitude - Cultivating Kindness and Compassion- Practicing Forgiveness- Celebrating Differences - Digital Detox.						
Unit:4		INTELLECTUAL WELL-BEING			3 hours	
Intellectual Well-being – Being a lifelong learner- Digital literacy - Transfer of Learning – Environmental well-being- Mental well-being – Importance of self-reflection (Discussion) - Meditation Practices.						
Unit:5		DEVELOPING LIFE SKILLS			3 hours	
Situational Awareness (Developing Life Skills) -Being Street Smart - General first aid procedure, CPR procedure, Handling emergency situations like fire, flood etc.- Digital Awareness – Understanding Addiction- Impact of substance abuse-Adverse health conditions, Social isolation, ruined future, hidden financial loss and damaging the family reputation.						
Unit:6		CONTEMPORARY ISSUES			1 hours	
Expert lectures, online seminars – webinars						
			Total Lecture hours		15 hours	

Text Book(s)	
1	Park's Text books of preventive and social medicine
2	Food and Nutrition by L. Swaminathan
Reference Books	
1	Dietics by Srilakshmi
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.youtube.com/watch?v=_5F9yTs7Al0
2	https://www.youtube.com/playlist?list=PLwdnzlV3ogoVhUuHDwFHzCj325BtEGZei
3	https://www.edx.org/learn/healthcare
4	https://open.umn.edu/opentextbooks/textbooks/662
Course Designed By: Dr. Gandhimathi R and Dr. Selvajeyanthi S	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	M	M	L
CO2	S	S	S	S	M	M	M	L	L	L
CO3	S	M	S	S	S	L	M	M	M	L
CO4	S	S	S	S	S	S	L	S	M	L

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



Course code	43P	M.Sc MICROBIOLOGY	L	T	P	C
Core		PRACTICAL III	-	-	5	4
Pre-requisite		Aware of clinically important microbes and its diagnosis techniques	Syllabus Version		2020-2021	
Course Objectives:						
- To impart knowledge on the sample collection, diagnosis and processing of clinical pathogen. - To evaluate the serological process in clinical pathogens						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To recall the isolation and identification of pathogen from various clinical specimens.					K1
2	To understand the diagnostics of clinically important fungi.					K3
3	To apply serology in the diagnosis of diseases.					K4
4	To impart knowledge on performing serological experiments for the diagnosis of parasitic infections.					K3
5	To understand viral cultivation procedures.					K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
1.Diagnostic Microbiology: Isolation and identification of pathogens from clinical specimens like urine, pus, faeces, sputum, CSF, blood and discharges.						
2.Isolation and identification of clinically important fungi - <i>Candida albicans</i> , <i>Aspergillus</i> sp, <i>Cryptococcus neoformans</i>						
3.Antibiotic susceptibility test. - Kirby Bauer technique						
4.Identification and enumeration of Lymphocytes.						
5.Examination of blood smear study for Plasmodium sp						
6.Agglutination reaction - Blood grouping & Rh Typing – Cross matching demonstration.						
7.Precipitation reaction – ODD Test.						
8.Serological Tests – WIDAL (Slide & Tube Test), RA, ASO, CRP, RPR.						
9.Pregnancy Test – β -hCG.						
10.Immunoelectrophoresis – Counter Current & Rocket Immunoelectrophoresis.						
11.ELISA – HIV, HBV & HCV.						
12.Separation techniques: Chromatography - Paper, TLC and Column.						
13.Virus cultivation – Egg inoculation techniques.						
					Total Lecture hours	75 hours
Text Book(s)						
1	Microbiology: A Laboratory Manual, 11th Edition, 2017. James G. Cappuccino and Chad T. Welsh , Pearson					
2	Laboratory Exercises in Microbiology, Fifth Edition, 2002. Harley–Prescott. The McGraw–Hill Companies.					
Reference Books						
1	Microbiology A Laboratory Manual, 10 th Edition, 2014. James G. Cappuccino and Natalie Sherman, Pearson					
	Microbiological Methods,8 th Edition, 2004. Collins and Lyne. Arnold Publishers.					
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]						
1	https://nabl-india.org/					
Course Designed By: Ms. N.Gunasheela						

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	L	M	M	L
CO2	S	S	S	S	M	L	M	M	M	M
CO3	S	M	S	S	S	M	L	M	L	L
CO4	S	S	S	S	S	M	M	M	M	L
CO5	S	S	S	M	S	L	L	M	M	L

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





Elective Courses

Course code	1EA	M.Sc. MICROBIOLOGY	L	T	P	C
Elective		GROUP A - ELECTIVE PAPER I - ARTIFICIAL INTELLIGENCE FOR BIOLOGICAL SCIENCES	5	-	-	4
Pre-requisite		Fundamentals about Machine learning	Syllabus Version		2020- 2021	
Course Objectives:						
The main objectives of this course are to: • Introduce Artificial Intelligence & machine learning for biology students • Facilitate students to learn & apply AI tools for solving research issues in biology • Understand the basics of automation • Develop automated solutions for research problems in biology						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concept of Artificial Intelligence					K2
2	Apply the knowledge of Machine learning and Deep learning techniques to solve real time problems					K3
3	Understand the application of Artificial Intelligence in microbe analysis and prediction of host – microbiome relationship					K2
4	Apply and validate Artificial Intelligence in clinical diagnosis of infectious disease					K4
5	Evaluate the role of Artificial Intelligence in the molecular mechanism behind drug discovery, sequencing and auto immune diseases					K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		ARTIFICIAL INTELLIGENCE (AI)			15 hours	
Introduction to AI – Fundamentals – Need for AI – Foundations of AI – AI environment – Application domains of AI – AI tools – Challenges and Future of AI.						
Unit:2		MACHINE LEARNING (ML) AND DEEP LEARNING (DL)			15 hours	
Fundamentals of ML and DL – ML algorithms to find associations across biological data, cellular image classification and identification of genetic variations.						
Unit:3		ARTIFICIAL INTELLIGENCE IN CLASSIFICATION AND PREDICTION IN MICROBIOLOGY			15 hours	
AI in bacterial counting - Prediction of Microbial Species - Prediction of Environmental and Host Phenotypes - Interaction Between Microorganisms – Microbiome - Disease Association - Using Microbial Communities to Predict Disease – pest management - Prediction of the Antimicrobial Activity						
Unit:4		ARTIFICIAL INTELLIGENCE IN CLINICAL MICROBIOLOGY			15 hours	
Artificial Intelligence Diagnostic Testing - AI and Gram Stain - AI and Parasitology - AI and Bacterial Culture Plate Images - AI and MALDI-TOF MS - AI and Whole Genome Sequencing						

Unit:5	ARTIFICIAL INTELLIGENCE IN MOLECULAR BIOLOGY	13 hours
Artificial Intelligence and Machine learning in autoimmune disease – AI in drug discovery -- AI in Phylogeny – AI and Whole Genome Sequencing - AI in next generation sequencing – AI in protein structure prediction – AI in protein folding analysis.		
Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	Paul P. Bourbeau, Nathan A. Ledeboer; Automation in Clinical Microbiology, Journal of Clinical Microbiology May 2013, 51 (6) 1658-1665; DOI: 10.1128/JCM.00301-13	
2	LeCun, Y., Bengio, Y. & Hinton, G. Deep learning. <i>Nature</i> 521 , 436–444 (2015). https://doi.org/10.1038/nature14539	
3	Kenneth P. Smith, Anthony D. Kang, James E. Kirby, Automated Interpretation of Blood Culture Gram Stains by Use of a Deep Convolutional Neural Network, Journal of Clinical Microbiology Feb 2018, 56 (3) e01521-17; DOI: 10.1128/JCM.01521-17	
4	Mahdiah Poostchia, Kamolrat Silamut, Richard J. Maude, Stefan Jaegera, George Thoma, Image analysis and machine learning for detecting malaria, Translational Research, Volume 194, April 2018, Pages 36-55, https://doi.org/10.1016/j.trsl.2017.12.004 .	
5	Cui W, Aouidate A, Wang S, Yu Q, Li Y, Yuan S. Discovering Anti-Cancer Drugs via Computational Methods. <i>Front Pharmacol.</i> 2020;11:733. Published 2020 May 20. doi:10.3389/fphar.2020.00733	
6	Clark RD. Putting deep learning in perspective for pest management scientists. <i>Pest Manag Sci.</i> 2020;76(7):2267-2275. doi:10.1002/ps.5820	
Reference Books		
1	Qu K, Guo F, Liu X, Lin Y and Zou Q (2019) Application of Machine Learning in Microbiology. <i>Front. Microbiol.</i> 10:827. doi: 10.3389/fmicb.2019.00827	
2	Park HS, Rinehart MT, Walzer KA, Chi J-TA, Wax A (2016) Automated Detection of <i>P. falciparum</i> Using Machine Learning Algorithms with Quantitative Phase Images of Unstained Cells. <i>PLoS ONE</i> 11(9): e0163045. https://doi.org/10.1371/journal.pone.0163045	
3	Yang X, Wang Y, Byrne R, Schneider G, Yang S. Concepts of Artificial Intelligence for Computer-Assisted Drug Discovery. <i>Chem Rev.</i> 2019;119(18):10520-10594. doi:10.1021/acs.chemrev.8b00728	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_me88/preview	
2	https://onlinecourses.nptel.ac.in/noc20_cs62/preview	
3	https://www.weforum.org/agenda/2019/05/how-artificial-intelligence-can-help-us-decode-human-immunity/	
Course Designed By: Dr. A. Vijaya Chitra		
Mapping with Programme Outcomes		

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	L	M	M	M	M	S
CO2	S	M	S	M	M	L	M	L	M	S
CO3	M	S	M	S	M	M	L	L	L	S
CO4	M	M	S	M	S	M	L	M	L	S
CO5	S	M	M	S	M	L	M	L	L	S

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



Course code	2EA	MSC MICROBIOLOGY	L	T	P	C
Elective		GROUP A - ELECTIVE PAPER II - PRINCIPLES OF QUALITY ASSURANCE AND TOTAL QUALITY MANAGEMENT	5	-	-	4
Pre-requisite		Aware of Management Skills	Syllabus Version		2020-2021	
Course Objectives:						
The main objectives of this course are to:						
• To understand the basics of quality assurance, aware of the good practices and regulations involved in management of hazardous substances • Comprehend quality assessment and management of quality assurance in laboratories • Make the learner competent on the concepts of Total Quality Management • Provide adequate knowledge on representation of data in graphical form						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To understand design and applications of microbiology lab and to outline good lab practices and first aid procedures					K2
2	To describe the maintenance of lab equipments and quality control records, facilitate the quality control of culture preparation and their maintenance					K1
3	To acquire the knowledge of effluent disposal with respect to biological reference and standard					K2
4	To provide information about the tools and techniques of total quality management.					K2
5	To impart knowledge about data analysis and data representation.					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		OVERVIEW OF QUALITY ASSURANCE AND MANAGEMENT			15 hours	
Quality assurance – Introduction and overview – Definition. Designing of microbiology laboratory – Control of quality – Applications. Good laboratory practices – Management of laboratory hazards and knowledge in First aid procedures.						
Unit:2		QUALITY ASSESSMENT AND ASSURANCE			15 hours	
Quality assessment of Equipments, chemicals, glass wares and laboratory environments – Variance – Quality control calculations – Quality management – Maintenance of records and reports. Quality assurance in sterilization and disinfection - Preservation of stock cultures, media and diagnostic kits – Quality control of media and stains						
Unit:3		QUALITY ASSESSMENT OF DISPOSAL			15 hours	
Quality assessment of disposal – decontaminated matters and other biological effluents – Quality management in transportations of cultures. National control of biological – Biological references and standards.						
Unit:4		TOTAL QUALITY MANAGEMENT			15 hours	
Concepts in TQM- Tools & techniques of TQM – Requirements for implementing TQM – Steps for implementing TQM – Questionnaire, Assessment through questionnaire – Mission statement – Benefits of TQM – Check list for implementing TQM – Case study.						

Unit:5	DATA AND GRAPHICAL REPRESENTATION	15 hours
Types of Data, tabular and Graphical summarization of numeric data: - Histograms & Stem and Leaf displays : Graphs for categorical data – Bar, Pie charts & Pareto diagrams. Graphs for time ordered data – Run charts, Cause effect diagrams – Check Sheets		
Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	Rajesh Bhatia and Rattan lal Ichhpujani. 1995. Ied. “Quality assurance in Microbiology	
2	Hugo B. S., Rusell, Pharmaceutical Microbiology, Blackwell Science	
3	Twelve Management skills for success – Ram Narain , Viva books private limited – Chennai.	
Reference Books		
1	Black S., Symour, Disinfection, Sterilization and Preservation, Philadelphia, London	
2	Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York, 2001.	
3	A cross functional perspective Total Quality Management – Rao, Carr, Dambolena and Kopp- John Wiley & Sons, New York.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	http://www.openlearningworld.com/books/Quality%20Management%20System/Quality%20Control/Quality%20Assurance.html	
Course Designed By: N.GUNASHEELA		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	L	M	L	L	M
CO2	S	S	M	S	M	M	M	M	L	M
CO3	S	M	S	M	S	L	M	L	L	M
CO4	S	S	M	S	S	M	L	M	L	L
CO5	S	S	S	M	S	M	M	L	L	L

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

Course code	4EA	M. Sc. MICROBIOLOGY	L	T	P	C
Elective		GROUP A - ELECTIVE PAPER III - QUALITY ASSESSMENT IN PHARMACEUTICALS	5	-	-	4
Pre-requisite		Aware of Quality systems in Pharmaceuticals	Syllabus Version		2020- 2021	
Course Objectives:						
- To develop knowledge of quality assurance guidance GMP, GLP and ICH in all areas that impact drug quality. - To accomplish GMP and quality related issues as well as various regulatory requirements						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Explain the role of drugs and antibiotics in pharmaceuticals.					K1
2	State the significance of sterility in pharmaceutical industry					K2
3	Impart knowledge on regulatory guidelines on production of natural, nutraceutical and veterinary antimicrobial products					K3
4	Impart knowledge on quality assurance in pharmaceutical manufacturing					K3
5	Validate the regulatory requirements for biotherapeutics and role of microbiologist in HACCP					K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		ANTIMICROBIAL DRUGS	13 hours			
An introduction to pharmaceutical microbiology. Chemical growth control. Chemical antimicrobial agents for external use, synthetic antimicrobial drugs, naturally occurring antimicrobial drugs: Antibiotics. Antibiotics from prokaryotes, antiviral drugs, antifungal drugs, antimicrobial drug resistance, the search for new antimicrobial drugs.						
Unit:2		SPOILAGE AND STERILIZATION	15 hours			
Types of spoilage, Factors affecting microbial spoilage – assessment of microbial spoilage – preservation. Ecology of microorganisms as it affects the pharmaceutical industry – Sterile pharmaceutical products – injections, Non injectable sterile fluids, Ophthalmic preparations, dressings & implants.						
Unit:3		CONTROL MEASURES	15 hours			
Sterilization control - methods of sterility testing- sterilization monitors and Quality assurance of products. The microbiological quality and regulatory requirements for natural and nutraceutical products, The regulatory control and quality assurance of immunological products, Containment system integrity – sterile products, Regulatory guidelines (microbiology) for veterinary antimicrobial products.						
Unit:4		QUALITY ANALYSIS	15 hours			
The role of the Qualified Person in microbiological quality assurance, Safety in microbiology, Rapid enumeration and identification methods, Selection and use of cleaning and disinfection agents in pharmaceutical manufacturing, Prevention and elimination of microbial biofilms in the manufacturing environment using Clean-in- Place, Cleanroom design, operation and regulatory standards.						

Unit:5	QUALITY ASSURANCE	15 hours
Microbiological quality assurance. Validation of aseptic processing and media fills, International disinfectant testing protocols, Measurement of biocide effectiveness, Microbiological quality and regulatory requirements for biotherapeutics and manufactured products, The role of the microbiologist in HACCP, Auditing the pharmaceutical microbiology department.		
Unit:6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	Hugo W.B. and A.D.Russel. 2004. Pharmaceutical Microbiology. 4 th Ed, Blackwell Scientific Publications.	
2	Dr Norman Hodges and Professor Geoff Hanlon (University of Brighton). Industrial Pharmaceutical Microbiology – Vol&Vol II: Standards & Controls Editors, (REF; www.euromed.uk.com).	
Reference Books		
1	Brock. Biology of Microorganisms. 2006. Madigan M.T. 11 th Edition, PearsonPrentice Hall, USA.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.openlearning.com/courses/pharmaceutical-quality-assurance/	
2	https://www.mooc-list.com/tags/pharmaceutical	
3	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge14/	
Course Designed By: Dr. R. Vijayaraghavan		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	M	M	M	L	M	M	M	L
CO2	M	S	M	S	M	L	L	M	L	M
CO3	M	M	M	S	S	M	M	M	L	L
CO4	M	S	S	M	S	M	M	M	M	L
CO5	S	S	S	S	S	L	L	M	M	L

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

Course code	4EPA	M.Sc. MICROBIOLOGY	L	T	P	C
Elective		GROUP A - ELECTIVE PAPER IV QUALITY ASSURANCE AND ASSESSMENT	-	-	5	4
Pre-requisite		Basic Knowledge in handling of Microbial cultures	Syllabus Version		2020-2021	
Course Objectives:						
- Enhance the knowledge of microbiological techniques in analysis of food samples and water quality - Make the learner to understand the concepts behind sterility in hospitals and industries and provide expertise training in sterility testing of pharmaceutical products - Broaden the knowledge in analysis of samples of manufactured products						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Enhance the knowledge in the field of testing of food products and be skillful as a quality supervisor in Food industry					K3
2	To understand and apply asepsis in pharmaceutical industry					K3
3	Analyze the chemical and biological quality of water					K4
4	To evaluate the microbial load in the environment.					K5
5	To analyse the impact of temperature on microbial death.					K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
1. Staining Techniques (Grams and LPCB)–Food samples- vegetables and packed foods.						
2. Sterility tests for Instruments – Autoclave & Hot Air Oven						
3. Sterility of Air and its relationship to Laboratory & Hospital sepsis.						
4. Sterility testing of Pharmaceutical products –Antibiotics, Vaccines & fluids						
5. Quantitative analysis of water – Membrane filter method						
6. Enumeration of microbes from industrial effluents.						
7. Evaluation of Drug potency by MIC.						
8. Isolation & characterization of Bacteria from wood and Paints.						
9. Water quality analysis – MPN.						
10. Estimation of BOD and COD.						
11. Isolation of microorganisms from spoiled foods – Meat, milk and Bread.						
12. Milk quality – Dye reduction test.						
13. Thermal death point and thermal death time.						
		Total Lecture hours			75 hours	
Text Book(s)						
1	Microbiology: A Laboratory Manual, 11th Edition, 2017. James G. Cappuccino and Chad T. Welsh , Pearson					
2	Laboratory Exercises in Microbiology, Fifth Edition, 2002. Harley–Prescott. The McGraw–Hill Companies.					
3	Hugo and Russell’s Pharmaceutical Microbiology, 7th Edition, 2004. Blackwell Publishers					

Reference Books	
1	Microbiology A Laboratory Manual, 10 th Edition, 2014. James G. Cappuccino and Natalie Sherman, Pearson
2	Microbiological Methods, 8 th Edition, 2004. Collins and Lyne. Arnold Publishers.
3	Manual of Diagnostic Microbiology, Dr.B.J.Wadher & Dr. G. L.Bhoosreddy, First .Ed., Himalaya publishing house, Nagpur.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://milnepublishing.geneseo.edu/suny-microbiology-lab/chapter/differential-staining-techniques/
2	https://www.cliffsnotes.com/study-guides/biology/microbiology/microscopy/staining-techniques
3	https://www.pharmaguideline.com/2013/06/determination-of-biological-oxygen.html
4	https://gibraltarlabsinc.com/services/microbiology/sterility-testing/
Course Designed By: Dr. A. Vijaya Chitra	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	M	M	L	M
CO2	S	S	S	S	S	L	M	S	M	M
CO3	S	S	M	S	S	L	L	L	L	M
CO4	S	S	L	S	S	M	M	S	M	L
CO5	S	S	S	S	S	M	L	S	L	L

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



Course code	1EB	M.Sc. MICROBIOLOGY	L	T	P	C
Elective		GROUP B - ELECTIVE PAPER I - ARTIFICIAL INTELLIGENCE FOR BIOLOGICAL SCIENCES	5	-	-	4
Pre-requisite		Fundamentals about Machine learning	Syllabus Version		2020- 2021	
Course Objectives:						
The main objectives of this course are to: • Introduce Artificial Intelligence & machine learning for biology students • Facilitate students to learn & apply AI tools for solving research issues in biology • Understand the basics of automation • Develop automated solutions for research problems in biology						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concept of Artificial Intelligence					K2
2	Apply the knowledge of Machine learning and Deep learning techniques to solve real time problems					K3
3	Understand the application of Artificial Intelligence in microbe analysis and prediction of host – microbiome relationship					K2
4	Apply and validate Artificial Intelligence in clinical diagnosis of infectious disease					K4
5	Evaluate the role of Artificial Intelligence in the molecular mechanism behind drug discovery, sequencing and auto immune diseases					K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		ARTIFICIAL INTELLIGENCE (AI)			15 hours	
Introduction to AI – Fundamentals – Need for AI – Foundations of AI – AI environment – Application domains of AI – AI tools – Challenges and Future of AI.						
Unit:2		MACHINE LEARNING (ML) AND DEEP LEARNING (DL)			15 hours	
Fundamentals of ML and DL – ML algorithms to find associations across biological data, cellular image classification and identification of genetic variations.						
Unit:3		ARTIFICIAL INTELLIGENCE IN CLASSIFICATION AND PREDICTION IN MICROBIOLOGY			15 hours	
AI in bacterial counting - Prediction of Microbial Species - Prediction of Environmental and Host Phenotypes - Interaction Between Microorganisms – Microbiome- Disease Association - Using Microbial Communities to Predict Disease – pest management - Prediction of the Antimicrobial Activity						
Unit:4		ARTIFICIAL INTELLIGENCE IN CLINICAL MICROBIOLOGY			15 hours	
Artificial Intelligence Diagnostic Testing - AI and Gram Stain - AI and Parasitology - AI and Bacterial Culture Plate Images - AI and MALDI-TOF MS - AI and Whole Genome Sequencing						

Unit:5		ARTIFICIAL INTELLIGENCE IN MOLECULAR BIOLOGY	15 hours
Artificial Intelligence and Machine learning in autoimmune disease – AI in drug discovery -- AI in Phylogeny – AI and Whole Genome Sequencing - AI in next generation sequencing – AI in protein structure prediction – AI in protein folding analysis.			
Unit:6		CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars			
		Total Lecture hours	75 hours
1	Paul P. Bourbeau, Nathan A. Ledebore; Automation in Clinical Microbiology, Journal of Clinical Microbiology May 2013, 51 (6) 1658-1665; DOI: 10.1128/JCM.00301-13		
2	LeCun, Y., Bengio, Y. & Hinton, G. Deep learning. <i>Nature</i> 521 , 436–444 (2015). https://doi.org/10.1038/nature14539		
3	Kenneth P. Smith, Anthony D. Kang, James E. Kirby, Automated Interpretation of Blood Culture Gram Stains by Use of a Deep Convolutional Neural Network, Journal of Clinical Microbiology Feb 2018, 56 (3) e01521-17; DOI: 10.1128/JCM.01521-17		
4	Mahdieh Poostchia, Kamolrat Silamut, Richard J.Maude, Stefan Jaegera, George Thoma, Image analysis and machine learning for detecting malaria, Translational Research, Volume 194, April 2018, Pages 36-55, https://doi.org/10.1016/j.trsl.2017.12.004 .		
5	Cui W, Aouidate A, Wang S, Yu Q, Li Y, Yuan S. Discovering Anti-Cancer Drugs via Computational Methods. <i>Front Pharmacol.</i> 2020;11:733. Published 2020 May 20. doi:10.3389/fphar.2020.00733		
6	Clark RD. Putting deep learning in perspective for pest management scientists. <i>Pest Manag Sci.</i> 2020;76(7):2267-2275. doi:10.1002/ps.5820		
Reference Books			
1	Qu K, Guo F, Liu X, Lin Y and Zou Q (2019) Application of Machine Learning in Microbiology. <i>Front. Microbiol.</i> 10:827. doi: 10.3389/fmicb.2019.00827		
2	Park HS, Rinehart MT, Walzer KA, Chi J-TA, Wax A (2016) Automated Detection of <i>P. falciparum</i> Using Machine Learning Algorithms with Quantitative Phase Images of Unstained Cells. <i>PLoS ONE</i> 11(9): e0163045. https://doi.org/10.1371/journal.pone.0163045		
3	Yang X, Wang Y, Byrne R, Schneider G, Yang S. Concepts of Artificial Intelligence for Computer-Assisted Drug Discovery. <i>Chem Rev.</i> 2019;119(18):10520-10594. doi:10.1021/acs.chemrev.8b00728		
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]			
1	https://onlinecourses.nptel.ac.in/noc20_me88/preview		
2	https://onlinecourses.nptel.ac.in/noc20_cs62/preview		
3	https://www.weforum.org/agenda/2019/05/how-artificial-intelligence-can-help-us-decode-human-immunity/		
Course Designed By: Dr. A. Vijaya Chitra			

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	L	M	M	L	M	S
CO2	S	M	S	M	M	M	M	M	M	S
CO3	M	S	M	S	M	M	L	M	L	S
CO4	M	M	S	M	S	L	L	M	L	S
CO5	S	M	M	S	M	L	M	M	M	S

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



Course code	2EB	M. Sc. MICROBIOLOGY	L	T	P	C
Elective		GROUP B - ELECTIVE PAPER II -COMMUNICABLE AND NON- COMMUNICABLE DISEASES	5	-	-	4
Pre-requisite		Aware of microbial pathogens and its diagnosis	Syllabus Version		2020- 2021	
Course Objectives:						
• Develop knowledge and choose epidemiological methods to investigate and manage outbreaks. • Apply knowledge of communicable and non-communicable disease epidemiology to strategies for prevention and control leading to improvements in public health.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Describe about various respiratory infections.					K1
2	Elaborate on the various intestinal infections.					K2
3	Discuss about different types of vector borne infections					K2
4	Acquire information about superficial mycosis and their diagnosis and treatment					K3
5	Know various non-communicable diseases and their preventive measures					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		RESPIRATORY INFECTIONS	13 hours			
Influenza, Mumps, Measles, Rubella, Acute respiratory infections and TB.						
Unit:2		INTESTINAL INFECTIONS	15 hours			
Polio, Cholera, Acute diarrhea diseases, Food poisoning, Typhoid, Amoebiasis, Ascariasis, Hook worm, Tapeworm, Pinworm infections.						
Unit:3		VECTOR BORNE INFECTIONS	15 hours			
Leprosy, STD – AIDS – Diagnostic Techniques and Treatment.						
Unit:4		SUPERFICIAL MYCOSES	15 hours			
Dermatophytoses – Opportunistic fungal infections – Candidiasis – Diagnostics Techniques and Treatment.						
Unit:5		NON-COMMUNICABLE DISEASES	15 hours			
Hyper Tension – Diabetes – Coronary Heart diseases – Cancer, Obesity, Blindness, Accidents – Preventive measures.						
Unit:6		CONTEMPORARY ISSUES	2 hours			
Expert lectures, online seminars – webinars						
			Total Lecture hours		75 hours	
Text Book(s)						
1	Dr. Jahan Evertt Park. 2015.Park's Text book of Preventive and social medicine.					
2	K C Sawant. 1993. Medical Microbiology. Dominant Publishers.					
3	K C Sawant. 2005. Virology. Dominant Publishers.					
4	Subrata Bhattacharjee. 2005. Bacteriology. Dominant Publishers.					
5	Dr Reba Kanungo. 2017. Ananthanarayan and Paniker's Textbook of Microbiology. 10 th Edition.					

Reference Books	
1	Samuel Baron. 1996. Medical Microbiology. 4 th Edition
2	R. C. Dubey, D. K. Maheshwari. 2010. A Textbook of Microbiology. S. Chand Publication.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.mooc-list.com/course/non-communicable-diseases-humanitarian-settings-coursera
2	https://www.who.int/health-topics/noncommunicable-diseases#tab=tab_1
3	https://www.mooc-list.com/course/global-disease-masterclass-communicable-diseases-epidemiology-intervention-and-prevention
Course Designed By: Dr. R. Vijayaraghavan	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	M	M	M	M	L	M	M	L
CO2	M	S	M	M	M	M	M	L	M	L
CO3	M	L	M	M	S	L	M	M	L	L
CO4	M	M	S	L	M	M	M	M	M	L
CO5	M	M	M	S	S	L	M	M	M	L

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



Course code	4EB	MSC MICROBIOLOGY	L	T	P	C
Elective		GROUP B - ELECTIVE PAPER III - HEALTH CARE OF THE COMMUNITY	5	-	-	4
Pre-requisite		Aware of Human Health Care Practices	Syllabus Version		2020- 2021	
Course Objectives:						
The main objectives of this course are to:						
• Improve and expand the availability of comprehensive health service • Expand access to health care services in underserved and rural areas. • Foster and encourage the use of health care delivery models that utilize team-based approaches where each member practices at the full scope of their training.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To gain information about nutrition, health, food adulteration and preventive measures.					K2
2	To understand the importance of physical and mental health.					K2
3	To emphasize the need of health programs and health education.					K3
4	Top apply the social culture to find the solutions for mental illness and drug addiction.					K3
5	To insist the need of family planning and reproductive health education.					K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		NUTRITION AND HEALTH			15 hours	
Balanced Diet, food surveillance, food fortifications- addition of vitamins and minerals - Adulteration and preventive steps.						
Unit:2		PHYSICAL HEALTH			15 hours	
Care of skin, hair, teeth, eyes. ears, hands and feet-physical exercises and their importance - Walking and jogging – Yoga and meditation – stress Relief.						
Unit:3		HEALTH EDUCATION			15 hours	
Health Programmes and health education-Malaria control – TB control – AIDS control programmes and Immunization programmes.						
Unit:4		MENTAL HEALTH			13 hours	
Social sciences and mental health – Sociology; Social structure, culture and customs – social problems-Mental health – cases of mental illness Alcoholism and drug dependence – prevention Rahabilitation.						
Unit:5		HEALTH PROGRAMME			15 hours	
Family planning, Maternal and child health – Antenatal and Postnatal care – Reproductive and child Health programme (RCH).						
Unit:6		CONTEMPORARY ISSUES			2 hours	
Expert lectures, online seminars – webinars						
Total Lecture hours			75 hours			

Text Book(s)	
1	Park's Text books of preventive and social medicine
2	Immune – biotechnology by Naha & Narain
3	Immunology by Dulsy Fatima & N.Arumugam
Reference Books	
1	Food and Nutrition by L.Swaminathan
2	Dietics by Srilakshmi 6.Practice of fertility control & Comprehensive manual 6th edition by S.K.Choudhary
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.classcentral.com/subject/public-health
2	https://onlinecourses.nptel.ac.in/noc19_mg50/preview
3	https://www.edx.org/learn/healthcare
Course Designed By:N.Gunasheela	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	M	M	L
CO2	S	S	S	S	M	M	M	L	L	L
CO3	S	M	S	S	S	L	M	M	M	L
CO4	S	S	S	S	S	S	L	S	M	L
CO5	S	S	S	M	S	S	M	L	M	L

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



Course code	4EPB	M.Sc MICROBIOLOGY	L	T	P	C
Elective Practical		GROUP B - ELECTIVE PRACTICAL IV WATER ANALYSIS AND HEALTH CARE	-	-	5	4
Pre-requisite		Basic knowledge about Biochemical Techniques	Syllabus Version		2020- 2021	
Course Objectives:						
- To train the learner in quality analysis of physico-chemical parameters of water - Provide expertise training in immunological testing procedures - Enhance the learner skill in microscopic observation of parasites						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Enhance the knowledge in the field of testing of food products and can be skillful as a quality supervisor in Food and Dairy industries					K5
2	Perform immunological assays and diagnosis of medical samples					K3
3	Perform analysis of environmental samples such as water.					K4
4	Understand the concepts of food adulteration					K3
5	Investigate samples for Protozoa and helminthic parasites.					K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
1. Water Analysis: Physicochemical parameters -pH, Turbidity, TDS, TSS, BOD, COD and DO						
2. Pasteurization of milk & Methylene Blue Dye Reduction test.						
3. Diagnostic test: Diabetic test, Hypertension test, Widal test, VDRL test						
4. Food Adulteration - any four food stuffs						
5. Radial Immunodiffusion test						
6. ELISA test						
7. Microscopic examination of Infectious Agents- Entamoeba, Ascaris, Hook worm, pinworm, Tape worm, Malarial parasite and Filarial parasite.						
8. Water Quality analysis- MPN						
		Total Lecture hours	75 hours			
Text Book(s)						
1	Microbiology: A Laboratory Manual, 11th Edition, 2017. James G. Cappuccino and Chad T. Welsh , Pearson					
2	Laboratory Exercises in Microbiology, Fifth Edition, 2002. Harley–Prescott. The McGraw–Hill Companies.					
Reference Books						
1	Microbiology A Laboratory Manual, 10 th Edition, 2014. James G. Cappuccino and Natalie Sherman, Pearson					
2	Microbiological Methods,8 th Edition, 2004. Collins and Lyne. Arnold Publishers.					
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]						
1	https://nabl-india.org/					
Course Designed By: Dr. A. Vijaya Chitra						

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	M	M	L
CO2	S	M	S	S	S	S	M	M	L	L
CO3	S	S	M	S	S	M	M	M	L	L
CO4	S	S	L	S	S	L	L	M	L	L
CO5	S	S	L	S	S	M	L	L	M	L

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



Course code	1EC	M.Sc MICROBIOLOGY	L	T	P	C
Elective		GROUP C - ELECTIVE PAPER I - ARTIFICIAL INTELLIGENCE FOR BIOLOGICAL SCIENCES	5	-	-	4
Pre-requisite		Fundamentals about Machine learning	Syllabus Version		2020- 2021	
Course Objectives:						
The main objectives of this course are to: • Introduce Artificial Intelligence & machine learning for biology students • Facilitate students to learn & apply AI tools for solving research issues in biology • Understand the basics of automation • Develop automated solutions for research problems in biology						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concept of Artificial Intelligence					K2
2	Apply the knowledge of Machine learning and Deep learning techniques to solve real time problems					K3
3	Understand the application of Artificial Intelligence in microbe analysis and prediction of host – microbiome relationship					K2
4	Apply and validate Artificial Intelligence in clinical diagnosis of infectious disease					K4
5	Evaluate the role of Artificial Intelligence in the molecular mechanism behind drug discovery, sequencing and auto immune diseases					K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		ARTIFICIAL INTELLIGENCE (AI)			15 hours	
Introduction to AI – Fundamentals – Need for AI – Foundations of AI – AI environment – Application domains of AI – AI tools – Challenges and Future of AI.						
Unit:2		MACHINE LEARNING (ML) AND DEEP LEARNING (DL)			15 hours	
Fundamentals of ML and DL – ML algorithms to find associations across biological data, cellular image classification and identification of genetic variations.						
Unit:3		ARTIFICIAL INTELLIGENCE IN CLASSIFICATION AND PREDICTION IN MICROBIOLOGY			15 hours	
AI in bacterial counting - Prediction of Microbial Species - Prediction of Environmental and Host Phenotypes - Interaction Between Microorganisms – Microbiome - Disease Association - Using Microbial Communities to Predict Disease – pest management - Prediction of the Antimicrobial Activity						
Unit:4		ARTIFICIAL INTELLIGENCE IN CLINICAL MICROBIOLOGY			15 hours	
Artificial Intelligence Diagnostic Testing - AI and Gram Stain - AI and Parasitology - AI and Bacterial Culture Plate Images - AI and MALDI-TOF MS - AI and Whole Genome Sequencing						

SCAA DATED: 15.05.2020

Unit:5	ARTIFICIAL INTELLIGENCE IN MOLECULAR BIOLOGY	13 hours
Artificial Intelligence and Machine learning in autoimmune disease – AI in drug discovery -- AI in Phylogeny – AI and Whole Genome Sequencing - AI in next generation sequencing – AI in protein structure prediction – AI in protein folding analysis.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	75 hours
Text Book(s)		
1	Paul P. Bourbeau, Nathan A. Ledeboer; Automation in Clinical Microbiology, Journal of Clinical Microbiology May 2013, 51 (6) 1658-1665; DOI: 10.1128/JCM.00301-13	
2	LeCun, Y., Bengio, Y. & Hinton, G. Deep learning. <i>Nature</i> 521 , 436–444 (2015). https://doi.org/10.1038/nature14539	
3	Kenneth P. Smith, Anthony D. Kang, James E. Kirby, Automated Interpretation of Blood Culture Gram Stains by Use of a Deep Convolutional Neural Network, Journal of Clinical Microbiology Feb 2018, 56 (3) e01521-17; DOI: 10.1128/JCM.01521-17	
4	Mahdieh Poostchia, Kamolrat Silamut, Richard J. Maude, Stefan Jaegera, George Thoma, Image analysis and machine learning for detecting malaria, Translational Research, Volume 194, April 2018, Pages 36-55, https://doi.org/10.1016/j.trsl.2017.12.004 .	
5	Cui W, Aouidate A, Wang S, Yu Q, Li Y, Yuan S. Discovering Anti-Cancer Drugs via Computational Methods. <i>Front Pharmacol.</i> 2020;11:733. Published 2020 May 20. doi:10.3389/fphar.2020.00733	
6	Clark RD. Putting deep learning in perspective for pest management scientists. <i>Pest Manag Sci.</i> 2020;76(7):2267-2275. doi:10.1002/ps.5820	
Reference Books		
1	Qu K, Guo F, Liu X, Lin Y and Zou Q (2019) Application of Machine Learning in Microbiology. <i>Front. Microbiol.</i> 10:827. doi: 10.3389/fmicb.2019.00827	
2	Park HS, Rinehart MT, Walzer KA, Chi J-TA, Wax A (2016) Automated Detection of <i>P. falciparum</i> Using Machine Learning Algorithms with Quantitative Phase Images of Unstained Cells. <i>PLoS ONE</i> 11(9): e0163045. https://doi.org/10.1371/journal.pone.0163045	
3	Yang X, Wang Y, Byrne R, Schneider G, Yang S. Concepts of Artificial Intelligence for Computer-Assisted Drug Discovery. <i>Chem Rev.</i> 2019;119(18):10520-10594. doi:10.1021/acs.chemrev.8b00728	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_me88/preview	
2	https://onlinecourses.nptel.ac.in/noc20_cs62/preview	
3	https://www.weforum.org/agenda/2019/05/how-artificial-intelligence-can-help-us-decode-human-immunity/	
Course Designed By: Dr. A. Vijaya Chitra		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	L	M	L	M	L	S
CO2	S	M	S	M	M	L	L	M	M	S
CO3	M	S	M	S	M	M	M	L	M	S
CO4	M	M	S	M	S	M	M	M	M	S
CO5	S	M	M	S	M	L	M	L	L	S

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



Course code	2EC	M. Sc. MICROBIOLOGY	L	T	P	C
Elective		GROUP C - ELECTIVE PAPER II - BIOPHYSICS AND BIOCHEMISTRY (2EA)	5	-	-	4
Pre-requisite		Fundamentals about structural information of Biologically active molecules	Syllabus Version		2020- 2021	
Course Objectives:						
• To develop the knowledge of biophysical methods in the analysis of biopolymers • To describe technological aspects of biological molecules • To provide basic understanding on biochemistry principles of biomolecules						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To impart knowledge about biophysical methods used for analysis of biopolymers					K1
2	To provide information on nucleic acid polymorphism					K2
3	To educate about radio-physics with respect to tracer techniques in biology					K2
4	To provide basic information on conversion and synthesis of macromolecules and their role in metabolism					K4
5	To understand various metabolic disorders and their molecular biology					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1		BIOPHYSICAL METHODS	15 hours			
Principles of biophysical methods used for analysis of biopolymer structure, X-ray diffraction, Hydrodynamic methods; plasma emission spectroscopy.						
Unit:2		NUCLEIC ACID HYBRIDIZATION TECHNIQUES	15 hours			
Principles and techniques of nucleic acid hybridization and Cot curves; Sequencing of Proteins and nucleic acids; Methods for measuring nucleic acid and protein interactions. Structural polymorphism of DNA, RNA and three dimensional structure of tRNA.						
Unit:3		TRACER BIOLOGY	13 hours			
Principles and applications of tracer techniques in biology; Radiation dosimetry; Radioactive isotopes and half life of isotopes; Effect of radiation on biological system.						
Unit:4		BIOCHEMISTRY	15 hours			
Interconversion of hexoses and pentoses; Amino acid metabolism; Coordinated control of metabolism; Oxidation of lipids; Biosynthesis of fatty acids; Triglycerides; Phospholipids; Sterols, Group transfer and Coupled reactions.						
Unit:5		CANCER BIOLOGY	15 hours			
Biochemistry and molecular biology of cancer; Oncogenes; Chemical carcinogenesis; Genetic and metabolic disorders; Hormonal imbalances; Drug metabolism and detoxification.						
Unit:6		CONTEMPORARY ISSUES	2 hours			
Expert lectures, online seminars – webinars						
			Total Lecture hours		75 hours	
Text Book(s)						
1	Gauri Misra. Introduction to biomolecular structure and biophysics, basics of biophysics. 2017. Springer					
2	Peter Jomo Walla. Modern biophysical chemistry: detection and analysis of biomolecules. 2014. Second, updated and expanded edition. Wiley publications.					
3	Thomas Jue. Hand book of modern biophysics. Biomedical applications of biophysics.2010.Volume 3. Humana Press.					

Reference Books	
1	Keith Wilson and John Walker. Principles and Techniques of biochemistry and Molecular biology. 2010. Seventh edition. Cambridge University Press.
2	Roger L. Lundblad, Fiona Macdonald. Hand book of biochemistry and molecular biology. 2018. CRC Press.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.swayam2.ac.in/cec20_bt12/preview
2	https://onlinecourses.swayam2.ac.in/cec20_bt19/preview
3	https://www.edx.org/course/medicinal-chemistry-the-molecular-basis-of-drug-di
Course Designed by: Dr.T.Savitha	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	M	S	S	S	M	L	L	L
CO2	S	M	L	L	M	S	L	M	M	L
CO3	L	M	S	L	S	S	M	L	M	L
CO4	M	S	L	S	L	S	L	M	L	L
CO5	S	L	M	M	M	S	M	M	L	L

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



Course code	4EC	M. Sc. MICROBIOLOGY	L	T	P	C
Elective		GROUP C - ELECTIVE PAPER III - MOLECULAR CYTOLOGY AND TISSUE ENGINEERING	5	-	-	4
Pre-requisite		Basic knowledge about Molecular Genetics	Syllabus Version		2020- 2021	
Course Objectives:						
CO1: To impart knowledge on molecular basis of signal transduction in life						
CO2: To provide technological aspects in cell and tissue culture						
CO3: To develop understanding of histological techniques						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Acquire the techniques in molecular cytology					K1
2	To understand the molecular background linked to signal transduction pathways and sex linked inheritance.					K2
3	To gain knowledge about DNA constancy and mutagenesis					K2
4	To Analyze the different cell and tissue culture techniques.					K4
5	To acquire the knowledge about the basics of mammalian systems.					K3
Unit:1						
Unit:1		BASIC TECHNIQUES	15 hours			
Molecular basis of signal transduction in bacteria, plants and animals; Model membranes; protein sorting, secretory and endocytic pathways, cell cycle; Dosage compensation and sex determination and sex-linked inheritance						
Unit:2						
Unit:2		DNA MUTAION AND EXPRESSION STUDIES	15 hours			
The law of DNA constancy and C-value paradox; Numerical, and structural changes in chromosomes; Molecular basis of spontaneous and induced mutations and their role in evolution; polypoidy; Environmental mutagenesis and toxicity testing; Population genetics. Environmental regulation of gene expression						
Unit:3						
Unit:3		TECHNIQUES OF CELL AND TISSUE CULTURE	13 hours			
Cell and tissue culture in plants and animals; Primary culture; Cell line; Cell clones; Callus cultures; Somaclonal variation; Micropropagation; Somatic embryogenesis; Haploidy; Protoplast fusion and somatic hybridization; Cybrides						
Unit:4						
Unit:4		GENE TRANSFER AND APPLICATIONS	15 hours			
Gene transfer methods in plants and in animals; Transgenic biology; Allopheny; Artificial seeds; Gene targeting. Applications of genetic engineering in agriculture, health and industry.						
Unit:5						
Unit:5		HISTOLOGY, PHYSIOLOGY AND HAEMATOLOGY	15 hours			
Histology – Basics of mammalian systems, nutrition, digestion and absorption; Circulation (open and closed circular, lymphatic systems, blood composition and function); Excretion and osmoregulation: Homeostatis (neural and hormonal); Bioluminescence.						
Unit:6						
Unit:6		CONTEMPORARY ISSUES	2 hours			
Expert lectures, online seminars – webinars						
			Total Lecture hours		75 hours	

Text Book(s)	
1	Bailey & Scotts Diagnostic Microbiology. 12 th edition. 2007.
2	Histology: A text and Atlas: with coorelated cell and Molecular biology. 2015.
Reference Books	
1	Leopold G.Koss & Myron R.Melamed (eds). Koss' Diagnostic cytology and its histopathologic bases. Volume2. 2005.
2	Jean Brachet. Molecular cytology. Volume 1: Cell cycle. 1985.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://study.com/articles/List_of_Free_Online_Pathology_Courses_and_Classes.html
2	https://www.futurelearn.com/courses/histology
Course Designed by: Dr.T.Savitha	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	M	S	L	M	M	L	L	L
CO2	M	S	L	M	M	M	L	M	M	L
CO3	L	M	S	L	S	M	M	M	L	L
CO4	S	L	M	L	M	L	L	M	L	L
CO5	M	L	L	M	S	L	M	L	L	L

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

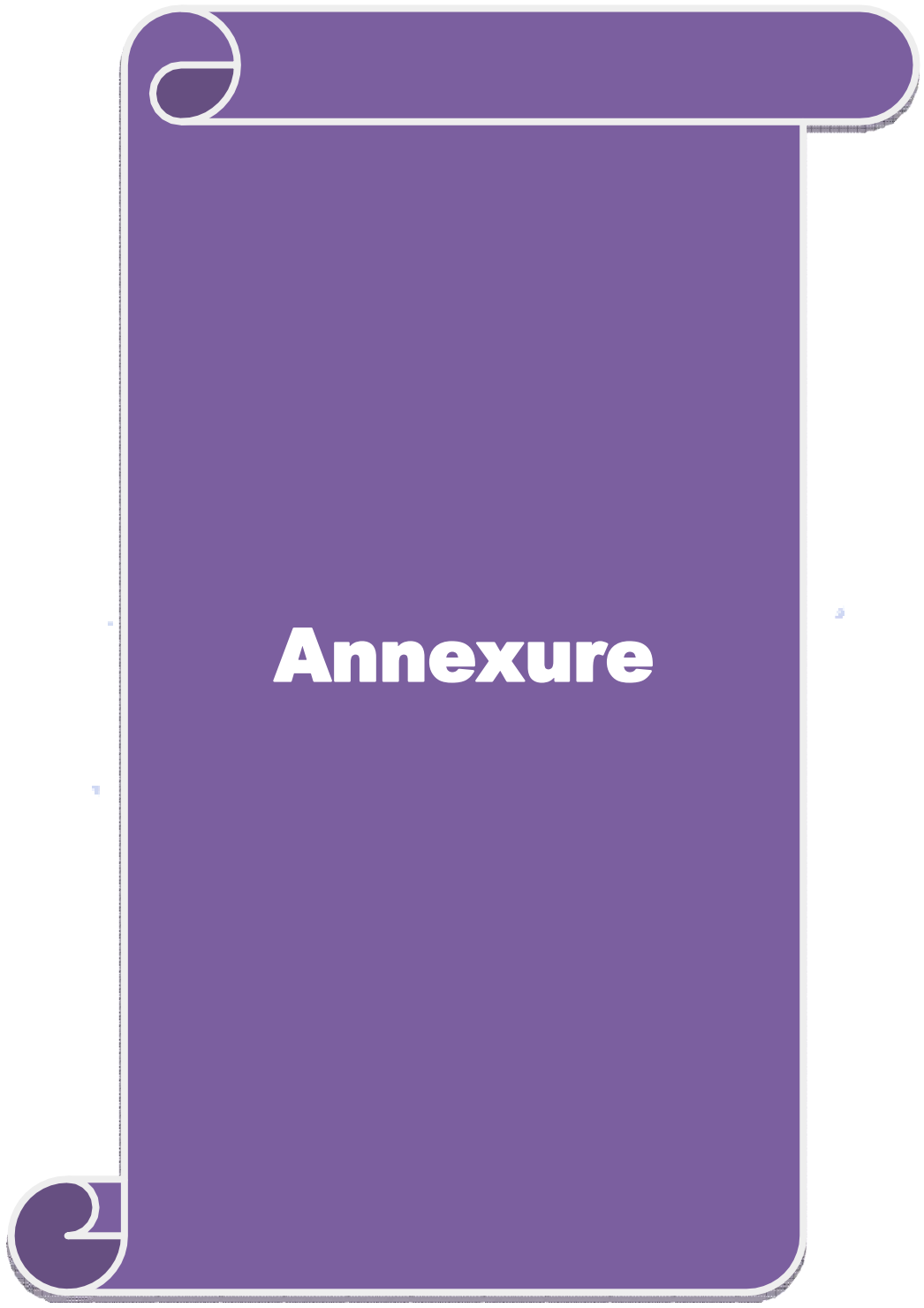


Course code	4EPC	M.Sc MICROBIOLOGY	L	T	P	C
Elective Practical		GROUP C – ELECTIVE PRACTICAL IV TECHNIQUES IN CYTOLOGY	-	-	5	4
Pre-requisite		Basic Knowledge about cytogenetic methods and plant tissue culture techniques	Syllabus Version		2020- 2021	
Course Objectives:						
• To provide the knowledge on cell divisions • To enhance technical skill on electrophoresis techniques • To impart the basics of callus and auxin production						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To learn the various stages of cell divisions.					K5
2	To estimate the total carbohydrate and proteins in the sample					K3
3	To induce mutation by UV radiations					K4
4	To visualize agglutination, precipitation patterns and agarose gel Electrophoresis					K3
5	To understand the phenomenon of callus, auxin production and bioluminescence					K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
1. Stages of cell division-mitosis and meiosis						
2. Estimation of total carbohydrates and proteins						
3. CS of dicot and monocot root and stem						
4. Physical mutation with UV						
5. Antagonistic activity of any one biocontrol agent						
6. Agarose gel electrophoresis						
7. Agglutination-Blood grouping, Precipitation-ODD						
8. Callus induction						
9. Auxin production						
10. Phenomenon of Bioluminescence						
			Total Lecture hours		75 hours	
Text Book(s)						
1	Microbiology: A Laboratory Manual, 11th Edition, 2017. James G. Cappuccino and Chad T. Welsh , Pearson					
2	Laboratory Exercises in Microbiology, Fifth Edition, 2002. Harley–Prescott. The McGraw–Hill Companies.					
Reference Books						
1	Microbiology A Laboratory Manual, 10 th Edition, 2014. James G. Cappuccino and Natalie Sherman, Pearson					
2	Microbiological Methods, 8th Edition, 2004. Collins and Lyne. Arnold Publishers.					
Course Designed by: Dr.T.Savitha						

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	M	M	L	L
CO2	S	M	S	S	S	S	M	M	M	L
CO3	S	S	M	S	S	S	M	M	L	L
CO4	S	S	L	S	S	L	M	M	L	L
CO5	S	S	L	S	S	S	L	L	M	L

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





Annexure

BHARATHIAR UNIVERSITY, COIMBATORE – 46
M.Sc. MICROBIOLOGY

(EFFECTIVE FROM THE ACADEMIC YEAR 2026 – 2027 ONWARDS)

VISION

Impart quality education with ethical values besides making the young minds to explore the world with great enthusiasm. Improve the academic qualities and capabilities, through building intellectual and imaginative minds with sophisticated education consequently making them a responsible citizen who can work for the advancement of the society.

MISSION

To nurture knowledge, skills, values and confidence in the students to grow, thrive and prosper. Inculcating optimistic thinking and positive spirit will establish global competence among student community. Promote the science of Microbiology through integrated application-oriented courses, with a view to pursue their goals and to produce all-round development of individuals in areas such as teaching-learning, research, entrepreneur and consultancy in the field of microbiology.



List of Group Elective papers (Colleges can choose any one of the Group papers as electives)

	GROUP A	GROUP B	GROUP C
Paper I/Sem I 1EA/1EB/1EC	Artificial Intelligence for Biological Sciences	Artificial Intelligence for Biological Sciences	Artificial Intelligence for Biological Sciences
Paper II/Sem II 2EA/2EB/2EC	Principles of Quality Assurance and Total Quality Management (TQM)	Communicable and Non communicable diseases	Biophysics and Biochemistry
Paper III/Sem IV 4EA/4EB/4EC	Quality Assessment in Pharmaceuticals	Health care of the community	Molecular Cytology and Tissue Engineering
Paper IV/Sem IV 4EPA/4EPB/4EPC	Quality Assurance and Assessment	Water Analysis and Health Care	Techniques in Cytology

List of Value-Added Courses offered (Colleges/Departments can choose any one of the papers in each/respective semester as Value Added Course)

Semester	Paper	Subject	Hrs Per week	University examination		Credits
				Duration in Hrs.	Max. Marks	
Odd Semester (I)	20PMBVAC1	Organic Farming	2	3	50	2
	20PMBVAC2	HACCP – Level 1 and 2	2	3	50	2
	20PMBVAC3	Human Anatomy and Medical Transcription	2	3	50	2
	20PMBVAC4	Introduction to Clinical research & Pharmaceutical medicine	2	3	50	2

Odd Semester (III)	20PMBVAC5	Basics in Bioinformatics	2	3	50	2
	20PMBVAC6	HACCP – Level 3	2	3	50	2
	20PMBVAC7	Medical Coding & Clinical data management	2	3	50	2
	20PMBVAC8	Entrepreneurial Microbiology	2	3	50	2

REGULATIONS OF SYLLABUS

A. Conditions for award of degree:

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed course of study in a college affiliated to the university for a period of not less than two academic years, passed the examination of all the four semesters prescribed with earning credits and fulfilled such conditions.

1. Duration of the course

The duration of the course is for two academic years consisting of four semesters.

2. Credits

The phrase credit denotes that the quantum of syllabus for various programmes in terms of study. It mainly focused on differential weightage given the contents and duration of the courses in the curriculum design. The total number of credits for this programme is 90.

3. Core and elective courses

Candidate admitted to PG Microbiology course should undertake 23 courses, of which 14 courses are of core theory papers, 3 courses of elective papers, 1 course of project and 4 practical courses along with 1 industrial training/ internship course.

4. Examinations

There will be four semester examinations: first semester examinations at the middle of the first academic year (November/ December) and the second semester examinations at the end of the first academic year (April/May). Similarly, the third and fourth semester examinations will be held at the middle and end of the second academic year respectively.

a. Theory examinations

The external evaluation will be based on the examinations to be conducted by the university at the end of each semester.

b. Practical examinations

Practical examinations will be conducted at the end of every semester.

5. Scheme of examinations

The scheme of examinations for different semesters will be as follows:

a. Theory paper

External	: 75 marks
Internal	: 25 marks
Total	: 100 marks
Time	: 3 hours

The following procedure will be followed for internal marks:

a. Theory papers Internal

Best two tests out of 3	: 15 Marks
Seminar	: 5 Marks
Assignment	: 5 Marks
Total	: 25 Marks

b. Practical : 25 Internal Marks

Experimental performance	: 10 Marks
Practical test (Best 2 out of 3)	: 10 Marks
Record	: 5 Marks

c. Project* : 200 Marks

Internal	: 50 Marks
External	: 150 Marks

Passing Minimum

- There will be no passing minimum for internal
- For external examinations, passing minimum will be of 50% of maximum marks allotted for the paper.
- In the aggregate (external + internal), the passing minimum will be of 50% for each paper/practical/ project and viva-voce.
- Grading will be based on overall marks obtained (external + internal).

Note: * to elaborate the following regarding to project:

- i. Students should carry out INDIVIDUAL PROJECT only
- ii. Project will be allotted at the beginning of Semester - IV only
- iii. In-house projects are encouraged
- iv. Students may be allowed to undertake their project work in other research institutes
- v. Faculty members of the respective colleges must serve as their guides
- vi. Co-guide from other institutions may be allowed only with the concern from guide.
- vii. Project report evaluation will be done and viva-voce will be conducted by both external examiner and the guide at the end of Semester - IV itself.
- viii. THREE copies of dissertation have to be submitted 15 days before the actual schedule of the project viva.

d. Grading system

The performance of the students is indicated by the SEVEN POINT SCALE GRADING SYSTEM as per the UGC norms given below

GRADE	GRADE POINT	PERCENTAGE OF MARKS	PERFORMANCE
O	9.5 and above	95-100	Outstanding
E	9.5 and above	85-94	Excellent
D	8.5 and above	+75-84	Distinction
A	7.5 and above	70-74	Very Good
B	7.0 and above	60-69	Good
C	6.0 and above	50-59	Average
RA	5.0 and above	Up to 49	Re-Appear

The overall performance level of the candidates will be assessed by the following formulae:

Cumulative weighted average of marks = $\Sigma (\text{marks} + \text{credits}) / \Sigma \text{credits}$

Cumulative weighted average grade points = $\Sigma (\text{Grade points} \times \text{Credits}) / \Sigma \text{Credits}$.

e. Industrial visit

Academic industrial visits to institutions and industries correlated to the courses during the semesters of study will outline part of the curriculum to reinforce the understanding of concepts and applications educated theoretically and practically. This kind of visits will be a boon to collect specimens and samples, to understand the scope and avenues of different subjects studied by students and the expectations of the organisation, who are employing them after the finishing point of their degree. Based on the desires, students could develop the required skills. Staff accompanying the students should be given non-remunerative OD for such visits.

6. The question paper pattern for all theory papers should be as follows:

Section	Type of questions	Marks
Part – A	Multiple choice questions (2 questions from each unit)	1x10= 10 Marks
Part – B	Internal choice questions (One question from each unit)	5x5= 25 Marks
Part – C	Internal choice questions (One question from each unit)	8x5= 40 Marks

Total: 75 Marks

7. The question paper pattern for all practical papers should be as follows:

Duration of practical time: 9 hours

Max.marks: 75

S. No	Components	Marks
1	Major experiment	25 Marks
2	Minor experiment I and II (15*2)	30 Marks
3	Identification of spotters (5x2)	10 Marks
4	Record	5 Marks
5	Viva-voce	5 Marks

