

**ALAGAPPA UNIVERSITY, KARAIKUDI**  
**SYLLABUS UNDER CBCS PATTERN FOR AFFILIATED COLLEGES**  
**WITH EFFECT FROM THE ACADEMIC YEAR 2022-23 ONWARDS**

**B.Sc., MICROBIOLOGY**  
**Programme Structure**

Sem.	Part	Course Code	Courses	Title of the Course	T/P	Credits	Hours/Week	Max. Marks		
								Int.	Ext.	Total
I	I	2211T	T/OL	Tamil /Other Languages -I	T	3	6	25	75	100
	II	712CE	E	Communicative English - I	T	3	6	25	75	100
	III	22BMI1C1	CC	General Microbiology	T	5	5	25	75	100
		22BMI1P1	CC	Practical-General Microbiology	P	4	4	40	60	100
		-	AL-IA	Biochemistry/ Botany Biotechnology / Zoology	T	3	3	25	75	100
	-	AL -IA	Practical - Respective Allied Theory Course	P	2	2	40	60	100	
	IV	22BVE1	SEC-I	Value Education	T	2	2	25	75	100
-		-	Library / Yoga/ Counseling/Field trip	-	--	2	--	--	--	
<b>Total</b>						<b>22</b>	<b>30</b>	<b>205</b>	<b>495</b>	<b>700</b>
II	I	2221T	T/OL	Tamil /Other Languages -II	T	3	6	25	75	100
	II	722CE	E	Communicative English - II	T	3	6	25	75	100
	III	22BMI2C1	CC	Microbial Physiology	T	5	5	25	75	100
		22BMI2P1	CC	Practical-Microbial Physiology	P	4	4	40	60	100
		-	AL-IB	Biochemistry/ Botany Biotechnology / Zoology	T	3	3	25	75	100
	-	AL -IB	Practical - Respective Allied Theory Course	P	2	2	40	60	100	
	IV	22BES2	SEC-II	Environmental Studies	T	2	2	25	75	100
Naan Mudhalvan Course		Language Proficiency for Employability(Effective English)	-	2	2	25	75	100		
<b>Total</b>						<b>24</b>	<b>30</b>	<b>230</b>	<b>570</b>	<b>800</b>
III	I	2231T	T/OL	Tamil /Other languages – III	T	3	6	25	75	100
	II	2232E	E	English for Enrichment - I	T	3	6	25	75	100
	III	22BMI3C1	CC	Molecular Biology	T	3	3	25	75	100
		22BMI3C2	CC	Microbial Genetics	T	3	3	25	75	100
		22BMI3P1	CC	Practical - Molecular Biology & Microbial Genetics	P	3	3	40	60	100
	-	AL-IIA	Biochemistry/ Botany Biotechnology / Zoology	T	3	3	25	75	100	
	-	AL-IIA	Practical - Respective Allied Theory Course	P	2	2	40	60	100	
IV	22BE3	SEC-III	Entrepreneurship	T	2	2	25	75	100	
	-	NME-I	1. Adipadai Tamil (or) 2. Advance Tamil (or) 3. IT Skills for Employment (or) MOOC'S	T	2	2	25	75	100	

				<b>Total</b>		<b>24</b>	<b>30</b>	<b>255</b>	<b>645</b>	<b>900</b>
IV	I	2241T	T/OL	Tamil /Other languages – IV	T	3	6	25	75	100
	II	2242E	E	English for Enrichment - II	T	3	3	25	75	100
	III	22BMI4C1	CC	Microbial Biochemistry	T	4	4	25	75	100
		22BMI4C2	CC	Immunology	T	4	4	25	75	100
		22BMI4P1	CC	Practical-Microbial Biochemistry & Immunology	P	3	3	40	60	100
		-	AL-II B	Biochemistry/ Botany Biotechnology / Zoology	T	3	3	25	75	100
	-	AL-II B	Practical - Respective Allied Theory Course	P	2	2	40	60	100	
IV	-	NME-II	1. Adipadai Tamil/ 2. Advance Tamil/ 3.Small Business Management / MOOC's	T	2	2	25	75	100	
		Naan Mudhalvan Course		Digital Skills for Employability – (Microsoft-Office Fundamentals)	-	2	3	25	75	100
				<b>Total</b>		<b>26</b>	<b>30</b>	<b>255</b>	<b>645</b>	<b>900</b>
V	III	22BMI5C1	CC	Medical Microbiology	T	4	4	25	75	100
		22BMI5C2	CC	Environmental Microbiology	T	4	4	25	75	100
		22BMI5C3	CC	Agricultural Microbiology	T	4	4	25	75	100
		22BMI5C4	CC	Microbial Biotechnology	T	4	4	25	75	100
		22BMI5P1	CC	Practical-Medical Microbiology	P	4	6	40	60	100
		22BMI5P2	CC	Practical-Environmental Microbiology	P	4	6	40	60	100
		-	-	Carrier development employability skills	-	-	2	-	-	-
				<b>Total</b>		<b>24</b>	<b>30</b>	<b>180</b>	<b>420</b>	<b>600</b>
VI	III	22BMI6I	DSE	Internship		24	26	150	250	400
	IV	Naan Mudhalvan Course		Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	-	2	4	25	75	100
				<b>Total</b>		<b>26</b>	<b>30</b>	<b>175</b>	<b>325</b>	<b>500</b>
				<b>(Or)</b>						
	III	22BMI6E1	DSE	Virology	T	6	6	25	75	100
		22BMI6E2		Mycology	T	6	6	25	75	100
		22BMI6E3		Microbial Technology	T	6	6	25	75	100
		22BMI6E4		Biosafety, IPR and Bioethics	T	6	6	25	75	100
	IV			Library/Yoga etc			2			
		Naan Mudhalvan Course		Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	-	2	4	25	75	100
			<b>Total</b>		<b>26</b>	<b>30</b>	<b>125</b>	<b>375</b>	<b>500</b>	
			<b>(Or)</b>							
III	22BMI6PR	DSE	Project		6	8	25	75	100	
	22BMI6E5		Industrial Microbiology	T	6	6	25	75	100	
	22BMI6E6		Food Microbiology	T	6	6	25	75	100	
	22BMI6E7		Dairy Microbiology	T	6	6	25	75	100	

	IV	Naan Mudhalvan Course	Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	-	2	4	25	75	100
	<b>Total</b>				<b>26</b>	<b>30</b>	<b>125</b>	<b>375</b>	<b>500</b>
	<b>Grand Total</b>				<b>146</b>	<b>---</b>	<b>--</b>	<b>--</b>	<b>4400</b>

\*Employability Readiness -Women's Colleges Naandi course and all other Colleges IBM Skills build Course.

Sem.	Part	Course Code	Title of the Paper	Credits	Hours/Week	Marks		
						Int.	Ext.	Total
I	III	71BEPL - I	Professional English for Life Science -I	4	5	25	75	100
II		72BEPL - II	Professional English for Life Science -II	4	5	25	75	100
III		*	Professional English for Life Science -III	4	5	25	75	100
IV			Professional English for Life Science -IV	4	5	25	75	100

\*The Syllabus of Professional English for III & IV Semester will be provided after Receiving the syllabus from TANSCHÉ.

**As per TANSCHÉ, the Professional English book will be taught to all four streams apart from the existing hours of teaching/additional hours of teaching (1hour/day) as a 4 credit paper as an add on course on par with Major paper and completion of the paper is a must to continue his/her studies further.**

- TOL-Tamil/Other Languages,
- E – English
- CC-Core course –Core competency, critical thinking, analytical reasoning, research skill & teamwork
- Allied -Exposure beyond the discipline
- AECC- -Ability Enhancement Compulsory Course (Professional English & Environmental Studies) - Additional academic knowledge, psychology and problem solving etc.,
- SEC-Skill Enhancement Course - Exposure beyond the discipline (Value Education , Entrepreneurship Course, Computer application for Science, etc.,
- NME -Non Major Elective – Exposure beyond the discipline
- DSE – Discipline specific elective – -Student choice – either or
  - Internship
  - If internship – Marks = Internal =150 (75+75) two midterm evaluation through Viva voce and External 250 marks (Report =150 +Viva Voce=100) =Total 400 marks
  - Theory papers or
  - Project + 3 theory papers.
- MOOCs – Massive Open Online Courses
  - \* T- Theory, P-Practical

I SEMESTER					
Course code: 22BMI1C1		Core Course I	T/P	C	H/W
		GENERAL MICROBIOLOGY	T	5	5
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To build a strong foundation in fundamentals of microorganisms</li> <li>➤ To acquire an overall knowledge on the morphology and functions of the structures with the prokaryotes and eukaryotes.</li> <li>➤ To know the principles of Microscopy and advancements in Microscopy</li> </ul>				
<b>Unit -I</b>	Definition and scope of Microbiology, History – spontaneous generation – Biogenesis, Contribution of Louis Pasteur, Leewen Hoek, Lazaro Spallanzani, John Tyndall, Joseph Lister, Robert Koch, Edward Jenner & Alexander Fleming.				
<b>Unit -II</b>	Microbial taxonomy, Binomial nomenclature, species concept Hackel's & Whittaker kingdoms, Principles of Classification – morphological, physiological, biochemical, numerical, and molecular taxonomy, Classification of bacteria according to Bergey's manual.				
<b>Unit -III</b>	Characteristic features of Prokaryotes and Eukaryotes: Prokaryotes – structure and function of cell wall, plasma membrane, flagella, slime, S layer, capsule, pili, cytoplasmic inclusion bodies, spore. Eukaryotes – structure & function of cell wall, plasma membrane, cilia, nucleus, mitochondria, chloroplast, lysosome, endoplasmic reticulum and Golgi complex.				
<b>Unit -IV</b>	Microscopy – simple, compound, light & dark microscopy, phase contrast, fluorescence and electron microscopy. Stains and Staining – principles of staining, types and classification of stains, definition of auxochrome, chromophores, Acidic and Basic dyes; Simple and differential staining: theories of staining, mordant and its function				
<b>Unit -V</b>	Media – Types and preparation – Sterilization – Principle and methods – dry heat, moist heat, filtration, radiation, antiseptics and disinfectants. Types of preservation methods. Culture technique – aerobic, anaerobic and semi aerobic. Culture collection centers in India (ITCC, MCC, and MTCC) and Abroad (ATCC, ECCO, JCM).				
<b>Books for Reference:</b>					
<p>Brock, T.D., Smith, D.W.,&amp; Madigan, N.T.(1987). <i>Biology of Micro organisms</i>sed.), Eniglewood Cliffs, NJ Prentice Hall K.</p> <p>Dubey, R.C., &amp; Maheswari, D.K. (2012). <i>A text of Microbiology</i> (Revised ed.).New Delhi: S. Chand and Company Ltd.</p> <p>Geeta, S., &amp;Mehrotra, R.S. (2009). <i>Principles of Microbiology</i> (1<sup>st</sup> ed.). New Delhi: Tata Mc</p> <p>John, L.I., &amp;Catherine, A. I. (2000).<i>Introduction To Microbiology</i> (2<sup>nd</sup> ed.). Brooks/Cole.</p> <p>Nester, E.W., Roberts, C.V., &amp; Nester, N.T. (1995). <i>Microbiology: A Human Perspectives</i>. USA: Brown (William C.) Co.</p> <p>Pelczar, J., Chen, E.C.S., Krieg, N.R. (1986). <i>Microbiology</i>. MC Grow Hill Company.</p> <p>Prescott, L.M., Harley, J.P., &amp; Klein, D.A. (2003). <i>Microbiology</i> (International Ed., 5<sup>th</sup> ed.) . New York: McGraw-Hill Education.</p> <p>Powar, C.B.,&amp;Daginawala, H.F.(2005).<i>General Microbiology</i>(Vol. 1 &amp; 2)(8<sup>th</sup> ed.). Mumbai: Himalaya Publishing House. Graw Hill Pvt. Ltd.</p>					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Knowledge on historical perspectives of Microbiology</li> <li>➤ Elaborate the structure and functions of Prokaryotes</li> <li>➤ Interpret the economically value fresh water and marine microbiology</li> <li>➤ Innovate the cultivation methods of pigments producing marine algae</li> </ul>				



<b>I SEMESTER</b>				
<b>Course code:</b> 22BMI1P1	<b>Core Practical – I</b>	<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>GENERAL MICROBIOLOGY</b>	<b>P</b>	<b>4</b>	<b>4</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To provide practical knowledge and skill in the isolation and handling of microorganisms.</li> <li>➤ To know pure culture techniques and methods of culturing</li> <li>➤ To learn the basic microbiological techniques</li> </ul>			
	<ol style="list-style-type: none"> <li>1. Laboratory safety measures</li> <li>2. Principles and applications of microbiology laboratory instruments</li> <li>3. Preparation of media and sterilization techniques</li> <li>4. Preparation of slant, stabs &amp; plating techniques</li> <li>5. Pure culture techniques – streak, spread &amp; pour plate techniques</li> <li>6. Motility of bacteria – hanging drop, soft agar methods</li> <li>7. Enumeration of bacteria and fungi from environmental samples</li> <li>8. Staining techniques – Simple, Gram's, Negative, Capsule &amp; Spore staining, LCB mount</li> </ol>			
<b>Books for Reference:</b>				
<p>Atlas R.M., A.E.Brown and L.C. Parks, Mosby, St. Louis , 1995, Laboratory Manual of Experimental Microbiology</p> <p>Cappuccino J.G. and N. Sherman 2002, Microbiology: A Laboratory Manual, Addison-Wesley.</p> <p>Holt J.G, N.R.Krieg, 2000, Bergey's Manual of Determinative Bacteriology. Ninth edition, Lippincott Williams &amp; Wilkin Publishers.</p> <p>Kannan N, 2002, Laboratory Manual in General Microbiology, Panima Publishers.</p> <p>Sundararaj T, 2003, Microbiology Laboratory Manual, 2<sup>nd</sup> Edition, A. Sundararj No.5, I cross street, Thirumalai Nagar, Perungudi, Chennai 600 096.</p>				
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Expertise in basic techniques of microbiology</li> <li>➤ Demonstrate the types of culture media and sterilization technique</li> <li>➤ Able to perform aseptic and pure culture techniques, preparation and viewing of sample under the microscope</li> </ul>			



<b>II SEMESTER</b>
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Course code: 22BMI2C1	Core Course II		T/P	C	H/W
	MICROBIAL PHYSIOLOGY		T	5	5
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To develop clear understanding of various aspects of microbial physiology.</li> <li>➤ To enable students to better understand courses taught later such as microbial pathogenicity-based courses.</li> </ul>				
<b>Unit -I</b>	Nutrition – types of nutrition – macro, micro and trace elements. Classification of microorganisms based on nutrient utilization – Autotrophs, heterotrophs, photo autotrophs, Photoheterotrophs, Chemo-organotrophs and chemolithotrophs. Physiology of extremophiles – Thermophiles, halophiles, psychrophiles and methanogens.				
<b>Unit -II</b>	Growth – Definition, growth curve, generation time, synchronous growth and continuous cultivation. Factors influencing microbial growth – Temperature, pH, O <sub>2</sub> , pressure, salt and nutrients.				
<b>Unit -III</b>	Transport across membrane – different types of mechanism – passive, facilitated transport and active transport. Different types of proteins ports - uniport, symport and antiport. Siderophores. Physiology phenomenon involved in membrane transport – Biochemical properties of membrane model.				
<b>Unit -IV</b>	Photosynthesis – types of phototrophs (oxygenic and anoxygenic), bacterial pigments – types, mechanism of photosynthesis – oxygenic and anoxygenic. Photophosphorylation – cyclic and non cyclic phosphorylation. Light and dark reaction				
<b>Unit -V</b>	Microbial respiration – aerobic and anaerobic – mechanism of aerobic respiration – Embden Mayer Hoff pathway, TCA cycle, electron transport chain. Oxidative phosphorylation mechanism of anaerobic respiration – sulfur reduction, ED pathway, microbial sporulation.				
<b>Books for Reference:</b>					
<p>Albert G. Moat &amp; John W. Foster, 2007, <i>Microbial physiology</i>, A John Wiley and sons, INC publications, New York.</p> <p>Caldwell D.R., 1995, <i>Microbial Physiology and Metabolism</i>, Brown Publishers.</p> <p>Dubey R.C &amp; Maheshwari D.K, 2009, <i>A text book of microbiology</i>, Chand &amp; Company Ltd. New Delhi.</p> <p>Geeta Sumbali and Mehrotra RS, 2009, <i>Principles of Microbiology</i>. First edition, Tata McGraw Hill P. Ltd., New Delhi.</p> <p>Geoffrey M. Cooper, 2007, <i>The cell, A molecular approach</i>, 3<sup>rd</sup> Edition - ASM press, Washington.</p> <p>Millian Meenakumari S, 2006, <i>Microbial physiology</i>, MJP. Publishers, Chennai.</p> <p>Moat G, John W. Foster and Michael P. Spector, 2002. <i>Microbial physiology</i>. Fourth edition, A John Wiley sons, Inc. publication. New Delhi.</p> <p>Pelczar Jr. M.J, Chan E.C.S. &amp; Kreig N.R, 2007, <i>Microbiology</i>, 5<sup>th</sup> Edition Mc.Graw Hill.</p> <p>Robert F Boyd, 1984, <i>General Microbiology</i>. Times mirror / Mosby college publishers.</p> <p>Rose A.H, <i>Advances in Microbial Physiology</i>. Volumes. Edited by Academic Press, New York.</p>					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Observe bacterial growth curve and explain its effect on environmental factors</li> <li>➤ Classify the photosynthetic pathways</li> <li>➤ Explain the transport mechanisms in microbes</li> <li>➤ Improve knowledge on biosynthesis of fatty acids and their different pathways</li> </ul>				

<b>II SEMESTER</b>				
<b>Course code:</b> 22BMI2P1	<b>Core Practical - II</b>	<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>MICROBIAL PHYSIOLOGY</b>	<b>P</b>	<b>4</b>	<b>4</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To understand the microbial growth kinetics and understanding different physiological phenomenon.</li> <li>➤ To deliver hands-on experience of various enzymatic assays</li> </ul>			
	<ol style="list-style-type: none"> <li>1. Growth curve and determination of generation time in <i>E. coli</i> and yeast.</li> <li>2. Factors affecting growth - temperature and pH</li> <li>3. Microbial physiology of various bacteria - Bio Chemical test               <ol style="list-style-type: none"> <li>a. Acid and gas production</li> <li>b. Starch hydrolysis</li> <li>c. Lipid hydrolysis</li> <li>d. IMViC test</li> <li>e. Catalase test</li> <li>f. H<sub>2</sub>S production</li> <li>g. Oxidase test</li> <li>h. Urease test</li> </ol> </li> </ol>			
<b>Books for Reference:</b>				
Atlas R.M., A.E.Brown and L.C. Parks, Mosby, St. Louis, 1995, <i>Laboratory Manual of Experimental Microbiology</i>				
Cappuccino J.G and N. Sherman, 2002, <i>Microbiology: A Laboratory Manual</i> , Addison-Wesley.				
Holt J.G, N.R. Krieg, Lippincott, 2000, <i>Bergey's Manual of Determinative Bacteriology</i> . Ninth edition, Williams & Wilkin Publishers.				
Kannan N, 2002, <i>Laboratory Manual in General Microbiology</i> , Panima Publishers.				
Sundararaj. T, <i>Microbiology Laboratory Manual</i> , 2003, Published by A. Sundararaj No.5, I cross street, Thirumalai Nagar, Perungudi, Chennai 600 096 2 <sup>nd</sup> Edition.				
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Identify the bacteria and classify the isolated bacteria from different sources</li> <li>➤ Demonstrate methods such as Micrometry, Haemocytometer and Turbidity method</li> <li>➤ Comparing different biochemical test for microbial identification</li> <li>➤ Practical knowledge on working principles of bioinstrumentations</li> </ul>			



<b>III SEMESTER</b>
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Course code: 22BM13C1		Core Course III MOLECULAR BIOLOGY	T/P T	C 3	H/W 3
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To extend the knowledge on the structure and functions of genetic materials</li> <li>➤ To focus on genome organization, transcription and translation process in prokaryotes.</li> </ul>				
<b>Unit -I</b>	DNA as genetic material (Griffith, Avery, Hershey and Chase experiments), RNA as a genetic material (Frannenkel and Conrat experiments), Nucleic acids – definition and structure. Nucleoside, nucleotide: definition and structure. DNA & RNA: Double helical structure. A-DNA, B-DNA & Z-DNA (structure and differences). General structure and types of RNA (tRNA, mRNA, rRNA).				
<b>Unit -II</b>	DNA Replication – conservative and semi conservative. Experimental proof for semi conservatives (Meselson-Stahl experiment), Mechanism of replication-Rolling-circle model. Enzymes involved in DNA replication, Process of prokaryotic transcription and translation.				
<b>Unit -III</b>	<b>Transcription:</b> Mechanism of Initiation - promoters, upstream and downstream sequences, transcription factors; <b>Elongation</b> - RNA polymerase, sub units; <b>Termination</b> - Rho dependent and Rho independent; nus A protein and antitermination.				
<b>Unit -IV</b>	<b>Genetic code:</b> Elucidation of triplet code, code characteristics and codon dictionary. Reading frames, sense and nonsense code. <b>Degeneracy</b> - wobble hypothesis, universality of genetic code.				
<b>Unit -V</b>	<b>Translation in prokaryotes:</b> Initiation and Termination. Role of rRNA in protein synthesis. <b>Post translational modifications</b> - Protein modification, folding, chaperones, transportation; signal hypothesis, protein degradation.				
<b>Books for Reference:</b>					
David R Hyde, 2010, <i>Genetics and Molecular biology</i> . Special Indian edition, Tata Mc Graw Hill P.Ltd., New Delhi.					
Friefelder David (Reprint), 2007, <i>Molecular Biology</i> , 2 <sup>nd</sup> Edition, MacMillan Pvt India Ltd, New Delhi.					
Hancock J.T, 2008, <i>Molecular Genetics</i> , Viva books Pvt Ltd.					
Lodish Berk, Matsudaira, Kaiser, Kreiger, Zipursky & Darnell, 2007, <i>Molecular cell biology</i> , 5 <sup>th</sup> Edition, W.H. Freeman & company, New York.					
Peter Paoella, 2010, <i>Introduction to Molecular Biology</i> . First edition, Tata Mc Graw-Hill P. Ltd., New Delhi.					
Ramawat and Shaily goyal, 2010, <i>Molecular biology and Biotechnology</i> . First edition S.Chand & Co.Ltd., New Delhi.					
Turner P.C, Mc Lennan A.G, Bates A.D & White M.R.H, 2002, Instant Notes Molecular Biology, Viva books Pvt Ltd.					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Receive elaborate knowledge on nucleic acids</li> <li>➤ Better understanding of gene expressions</li> <li>➤ Identify the process of central dogma</li> </ul>				





Course code: 22BMI3C2		Core Course IV MICROBIAL GENETICS	T/P T	C 3	H/W 3
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To understand how microorganisms can be used as tools to understand various biological phenomena.</li> <li>➤ To become familiar with methods of transfer of genetic material in bacteria</li> </ul>				
<b>Unit -I</b>	<b>Biochemical basis of mutation:</b> Spontaneous mutation – random and non – adaptive mutation. Mutation rates. <b>Origin of spontaneous mutation</b> – isolation of mutants. <b>Detection of mutagen</b> – Ames test, <i>in vitro</i> mutagenesis.				
<b>Unit -II</b>	<b>Plasmids:</b> Types and Properties of plasmids – sex factors, drug resistant, colicinogenic, <i>Agrobacterium</i> Ti and broad host range plasmid. Copy number, replication- circular and theta. amplication and incompatibility.				
<b>Unit -III</b>	DNA damage, Concept of mutations and mutagenesis, Molecular basis of spontaneous and induced mutations [physical and chemical mutagenic agents], types of mutation, DNA repair mechanisms - excision, mismatch, SOS, photoreactivation.				
<b>Unit -IV</b>	Conjugation: Discovery, F+, F- and Hfr cells and F- genetic crosses. Transformation – competent cells – mechanism, transduction – generalized and specialized. Transposition				
<b>Unit -V</b>	Regulation of gene expression – structural and functional gene, operon – inducible operon – lac operon, repression operon – Trp operon, attenuation. Ara operon.				
<b>Books for Reference:</b>					
Hancock J.T, 2008, <i>Molecular Genetics</i> , Viva books Pvt Ltd.					
Peter J.Russell, 2000, <i>Fundamentals of Genetics</i> , 5 <sup>th</sup> Edition, Benjamin/Cummings Publishers.					
Peter Snustad D and Michael J Simmons, 2003, <i>Principles of Genetics</i> . Third edition, John Wiley and Sons, Inc. publication, New Delhi.					
Sambamurty, A. V. S. S. (2007). <i>Molecular Genetics</i> . Narosa Publication.					
Sanders, M.F. and Bowman, J.L. (2018). <i>Genetic Analysis: An Integrated Approach</i> . Pearson Publisher.					
Stanley R. Maloy, John E. Cronan & David Freifelder, 2008, <i>Microbial Genetics</i> , 2 <sup>nd</sup> Edition, Narosa Publishing House.					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Will define gene organization and compare prokaryotes and eukaryotes</li> <li>➤ Categories the mutation and recombination is important to the genetic diversity</li> <li>➤ Discuss about transposable elements both in prokaryotes and eukaryotes</li> </ul>				



III SEMESTER					
Course code:	Core Practical III		T/P	C	H/W
22BMI3P1	<b>MOLECULAR BIOLOGY AND MICROBIAL GENETICS</b>		<b>P</b>	<b>3</b>	<b>3</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To impart knowledge on the isolation and estimation of nucleic acids</li> <li>➤ To practice the students in gene transfer technology</li> </ul>				
<ol style="list-style-type: none"> <li>1. Isolation of antibiotic resistance mutant by replica plating</li> <li>2. Isolation of DNA from bacteria and yeast</li> <li>3. Estimation of DNA – diphenyl method</li> <li>4. Electrophoretic separation of DNA</li> <li>5. Isolation of RNA</li> <li>6. Estimation of RNA</li> <li>7. Electrophoretic separation of RNA</li> <li>8. Preparation of competent cells</li> <li>9. Gene transfer by conjugation</li> <li>10. Gene transfer by transduction</li> <li>11. AMES Test</li> <li>12. Isolation of petite mutant.</li> </ol>					
<b>Books for Reference:</b>					
Atlas R.M., A.E.Brown and L.C. Parks, Mosby, St. Louis, 1995, Laboratory Manual of Experimental Microbiology					
Cappuccino J.G and N. Sherman, 2002, Microbiology: A Laboratory Manual, Addison-Wesley.					
Kannan N, 2002, Laboratory Manual in General Microbiology, Panima Publishers.					
Murray, R.G.F., Wood, W.A. and Krieg, N.B, 1997, Methods for General and Molecular Bacteriology.					
Sundararaj. T, Microbiology Laboratory Manual, 2003, Published by A. Sundararaj No.5, I cross street, Thirumalai Nagar, Perungudi, Chennai 600 096 2 <sup>nd</sup> Edition.					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Trained in isolation of nucleic acids</li> <li>➤ Become familiar in gene transfer technology</li> <li>➤ Focus on and understand the molecular technique</li> </ul>				



<b>IV SEMESTER</b>				
<b>Course code:</b> 22BMI4C1	<b>Core Course V</b>	<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>MICROBIAL BIOCHEMISTRY</b>	<b>T</b>	<b>4</b>	<b>4</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To know the structural organization of bio-molecules</li> <li>➤ To learn the characteristics of nucleic acids, enzymes and vitamins</li> <li>➤ To acquire knowledge on secondary metabolites</li> </ul>			
<b>Unit -I</b>	Definition and scope of biochemistry , Basic concepts of atoms, molecules and types of bonding in biomolecules, Isomerism – types, structural – stereo and optical.			
<b>Unit -II</b>	Nomenclature, definition and classification of carbohydrates, structural characteristic of Monosaccharide, disaccharides and Polysaccharides.			
<b>Unit -III</b>	Amino acids – structure, classification and properties. Primary, secondary and tertiary structure of proteins, Physical and chemical properties of protein.			
<b>Unit -IV</b>	Fatty acids – Definitions and classification (Saturated and unsaturated), lipids-properties of lipids, Types of lipids, Compound lipids – Phospholipids and Glycolipids, Derived lipids – steroids, Terpens and Carotenoids.			
<b>Unit -V</b>	Vitamins – source and classification, types – Water soluble (B, C) and fat soluble vitamins (A, D, E, K). Enzymes – Nomenclature, Classification and its Properties, mechanism of enzyme action.			
<b>Books for Reference:</b>				
Cantor C.R. and P.R. Schimmel, <i>Biophysical Chemistry</i> , 1980, Part I: The Conformation of Biological Macromolecules, Part II: Techniques for the Study of Biological Structure and Function.				
Deb AC, 2007, <i>Concepts of Biochemistry</i> , (Theory and Practical) Books and Allied (P) Ltd., Kolkata.				
Jain JL, 2003, <i>Fundamentals of Biochemistry</i> . S. Chand and Company Ltd., New Delhi.				
Keith Wilson and Jon Walker, <i>Practical Biochemistry</i> , Cambridge University Press.				
Murray RK, DK Granner, PA Mayes and VW Rodwell, 1999. Harper's Biochemistry. 27th Edition, Large Medical Publication.				
Satyanarayana.U, 2005. <i>Essentials of Biochemistry</i> , Books and Allied (P) Ltd., Kolkata.				
Stryer. L. et al., 2006, <i>Biochemistry</i> , 5th edition, WH Freeman publication.				
Van Holde K.E, W.C. Johnson, and P.S.Ho, 1998, <i>Principles of Physical Biochemistry</i> .				
Veerakumari L, 2007, <i>Biochemistry</i> . MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.				
Voet, D., and Voet JG. 1995, <i>Biochemistry</i> , Wiley publication				
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Knowledge on metabolism of biomolecules</li> <li>➤ General Information about nucleic acids, enzymes and vitamins</li> <li>➤ Clear idea on secondary metabolites and their biosynthetic pathways.</li> </ul>			



<b>IV SEMESTER</b>				
<b>Course code:</b> 22BMI4C2	<b>Core Course VI</b>	<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>IMMUNOLOGY</b>	<b>T</b>	<b>4</b>	<b>4</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To learn about the structural features and components of the immune system.</li> <li>➤ To understand the various components of the host immune system</li> </ul>			
<b>Unit -I</b>	History of immunology–Structures and functions of cells and organs involved in immune system, Primary and Secondary lymphoid organs. Types of immunity – Innate and acquired, Acquired immunity – humoral and cell mediated immune response, Clonal selection theory.			
<b>Unit -II</b>	Cytokines – Properties and functions, Immunoglobulins – structure, types and function. Immunogenicity – Immunogens, adjuvants, epitopes, haptens and carriers, complement system – classical and alternate pathway.			
<b>Unit -III</b>	Antigens – types, chemical nature, antigenic determinants – Factors affecting antigenicity. Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups. Labeled antibody based techniques – ELISA, RIA and Immunofluorescence.			
<b>Unit -IV</b>	Major histocompatibility complex (MHC) – structure and its interaction with peptide, Toll-like receptors, Immune response to infectious diseases – bacterial, viral, protozoan and helminthes. Autoimmune disorders.			
<b>Unit -V</b>	Transplantation immunity – Organ transplantation and HLA tissue typing, Hypersensitivity Reactions – Type I, II, III and IV, Congenital and Acquired Immunodeficiencies, Inflammation, Hybridoma and monoclonals. Immunization – active and passive.			
<b>Books for Reference:</b>				
Anathanarayan R and Jeyaram Panikers C.K. 2013. <i>Text Book of Microbiology</i> . Ninth Edition. Jain book depot, New Delhi.				
Bashir SF, 2011, <i>Text Book of Immunology</i> . First edition, PHI Learning Private limited, New Delhi.				
Kannan I, 2007, <i>Immunology</i> . First edition, MJP Publishers, Chennai.				
Klaus D.Elgent, 1996, <i>Immunology understanding of immune system</i> , Wiley Liss NY.				
Kuby, J, 1997, <i>Immunology</i> , II Edition WH, IVEeman and Company, New York.				
Madhavee Latha, 2012, <i>A Text book Immunology</i> . First edition, S.Chand & Company Ltd, New Delhi.				
Roitt, IM 1998, <i>Essential of Immunology</i> ELBS Blackwell Scientific Publication.				
Stites D.P.Terr, A.I., Parslow, T.G. <i>Medical Immunology</i> , 9 <sup>th</sup> Edition, Appleton and larnge, Stamford, 1993.				
Tizard K, 1983, <i>Immunology. An Introduction</i> . Saunders college publishing, Philadelphia.				
Topley and Wilsons, 1995, <i>Text Book on Principles of Bacteriology, Virology and Immunology</i>				
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Define the immunology and explain the immune system</li> <li>➤ Discuss the role of Immunoglobulins</li> <li>➤ Analyze antigen responses to microbial infections</li> </ul>			



<b>IV SEMESTER</b>						
<b>Course code:</b> 22BMI4P1	<b>Core Practical IV</b>			<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>MICROBIAL BIOCHEMISTRY AND IMMUNOLOGY</b>			<b>P</b>	<b>3</b>	<b>3</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To provide practical knowledge in the isolation and characterization and to understand the soil microbes.</li> <li>➤ To learn about the structural features of the immune system as well as their functions and responsiveness.</li> </ul>					
<ol style="list-style-type: none"> <li>1. Chromatography               <ol style="list-style-type: none"> <li>a. Paper chromatography – circular.</li> <li>b. Thin layer chromatography - separation of amino acid.</li> </ol> </li> <li>2. Carbohydrates: Quantitative estimation of glucose from bacterial and yeast cell.</li> <li>3. Protein: Quantitative estimation of protein from bacterial and yeast cell.</li> <li>4. Assay of amylase from microbes.</li> <li>5. Assay of protease from microbes</li> <li>6. Cell immobilization in calcium alginate gel</li> <li>7. Blood cell counts: Total RBC, WBC and differential count of WBC.</li> <li>8. Agglutination reactions: Haemagglutination, ABO blood grouping</li> <li>9. Precipitation reactions: Precipitin ring test, single and double diffusion test</li> <li>10. Immunodiagnostic procedures: ELISA, Western blotting</li> <li>11. Diagnostic test: HIV, malaria, VDRL and pregnancy test.</li> </ol>						
<b>Books for Reference:</b>						
<p>Jayaraman, J. (1981). Laboratory Manual in Biochemistry. New Delhi: New Age International(Pvt.) Ltd. Publishers.</p> <p>Demain, A.L, and Davis, J.E. (1999). Manual of Industrial Microbiology and Biotechnology (2<sup>nd</sup> ed). Washington: American Society for Microbiology.</p> <p>Abbas Abul K. Lightman Andrew K. and Pober Jordan S. Cellular and Molecular immunology W.B Saunders Company, Philadelphia.</p> <p>Gold by Richard A. Kindt Thomas J and Osborne Barbara A. Kuby Immunology, W.H.Freeman and Company, New York.</p> <p>Jawetz Me hick, Adel berg Brooks, Butel and Orston, Medical Microbiology, Prentice Hall Incorporated London.</p> <p>Rastogi S.C.1996. Immunodiagnosics Principles and Practice, New Age International (P) Ltd., New Delhi.</p> <p>Monica Cheesbrough, 2000. District Laboratory Practice in Tropical Countries, Part – 2, Cambridge University Press, Cambridge, U.K.</p>						
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Classify a quality techniques</li> <li>➤ Evaluation of microbes in soil</li> <li>➤ Observe and discuss about the antigen antibody reaction</li> </ul>					



<b>V SEMESTER</b>				
<b>Course code:</b> 22BMI5C1	<b>Core Course VII</b>	<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>MEDICAL MICROBIOLOGY</b>	<b>T</b>	<b>4</b>	<b>4</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To inculcate on the role of normal flora and pathogenic microbes</li> <li>➤ To understand the pathogenesis of various diseases</li> <li>➤ To understand the various clinical microbiological techniques</li> </ul>			
<b>Unit -I</b>	General approach to clinical specimen – collection and transport, microbiological examination, transport media for isolation. General principle – isolation techniques involved for anaerobic bacteria, normal micro flora of the human body.			
<b>Unit -II</b>	Bacteriology – general characteristics – pathogenicity, lab diagnosis, epidemiology and prevention of pneumonia, tuberculosis, cholera, typhoid and anthrax			
<b>Unit -III</b>	Virology: History of virology – General properties of viruses, Classification of viruses, Reproduction of bacterial phages – T7, M13 and lambda phages, one step growth, synthesis and assembly, release of phages, epidemiology and prevention of chicken pox, hepatitis, mumps, AIDS, dengue and SARS.			
<b>Unit -IV</b>	Parasitology: general characteristics, pathogenesis, Lab diagnosis – prevention of Amoebiasis, Leishmaniasis, Malaria, Ascaris, Filariasis. Mycology: general characteristics, mechanism of pathogenesis, Lab diagnosis and prevention of superficial, subcutaneous, systemic and opportunistic Mycoses			
<b>Unit -V</b>	Antimicrobial chemotherapy – General Character – mechanism of action of drugs, Antimicrobial susceptibility test – Anti bacterial drug (B lactum), Anti viral drug (amantadine) and Antifungal drug (ketoconazole), Drug resistance – mechanism, origin and transmission of drug resistance.			
<b>Books for Reference:</b>				
Anathanarayan R and Jeyaram Panikers C.K. 2013. <i>Text Book of Microbiology</i> . Ninth Edition. Jain book depot, New Delhi.				
Bailey & Scotts, Diagnostic Microbiology Elen JO Baron Lance R. Peterson, Sydney M.Fine Gold 9 <sup>th</sup> Edn. Pub Mosby.				
Baron EJ, Peterson LR and Finegold SM, 1994, Bailey and Scotts diagnostic microbiology. 9th edition, Mosby publications.				
Chakraborty P, 2003, <i>A Text book of Microbiology</i> . Second edition, Published by New Central Agency (P) Ltd., Kolkata.				
Chatterjee KD, 1980, parasitology, Protozoology and Helmmthology – 12 <sup>nd</sup> Edn Chatterjee Medical Publisher				
Cruickshnak R. 1975, <i>Medical Microbiology</i> . VoL I & II ELBS, Churchill Livingston				
Jewetz and Melnich, 1986, <i>Review of Medical Microbiology</i> , Lenge Medical Publications, Maurzon Go. Ltd.				
Mackie & Mcpartney, 1997, <i>Medical Microbiology – Vol. – I, Microbial – infection</i> , 7 <sup>th</sup> Edn. Ed,–Jg. Collee A.G. Fraser B.P. Marimion, A. Simmons Churchill-Livingston				
Rajan S, 2009, <i>Medical Microbiology</i> . First edition, MJP Publishers, Chennai. 6.				
Satish Gupte ,2000, <i>The Short Textbook of Medical Microbiology</i> . Eighth edition,				

Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.

**Outcomes**

- Understand the normal flora of human body
- Know about the clinical technology
- Understand the human pathogen



V SEMESTER						
Course code: 22BMI5C2		Core Course VIII ENVIRONMENTAL MICROBIOLOGY		T/P	C	H/W
				T	4	4
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To become familiar with current research in environmental microbiology.</li> <li>➤ To learn the basic principles of environment microbiology to understanding and solving problems in water quality and bioremediation.</li> </ul>					
<b>Unit -I</b>	Microbial ecology- Concept, development of microbial community in biosphere, biofilm and its ecological implication. Microbial diversity, extremophiles- ecological adjustment and molecular adaptations in extreme conditions.					
<b>Unit -II</b>	Air microbiology – microbes in aerosol, indoor and outdoor environment, assessment of quality of air, air borne disease caused by bacteria, fungi and viruses – symptoms and preventive measures. Bio-degradation – xenobiotics, bio accumulation, biomagnification and Bioleaching					
<b>Unit -III</b>	Aquatic Microbiology – Microbes in fresh and marine environment, Eutrophication. Aquatic habitats - freshwater - lakes, ponds and streams; marine habitats - estuaries, deep sea, hydrothermal vents, and mangroves and their microbial communities; zonation – test for potability of water – microbial quality testing of water – water born disease and preventive measures.					
<b>Unit -IV</b>	Treatment of solid wastes - Thermal Treatment: Incineration, Gasification, Pyrolysis and Open Burning- Dumps and Landfills: Sanitary landfills, Controlled dumps, Bioreactor Landfills-Biological Waste Treatment: Composting, Vermicomposting.					
<b>Unit -V</b>	Treatment of liquid wastes – characteristic of liquid waste – measurement of BOD & COD. Primary, secondary, tertiary treatment; anaerobic (methanogenesis), aerobic, trickling, activated sludge, oxidation pond.					
<b>Books for Reference:</b>						
Alexander, M. 1971, <i>Microbial Ecology</i> , John-Wiley & Sons, inc. New York.						
Baker, K.H and Herson D.S. 1997, <i>Bioremediation</i> , McGraw Hill, inc. New York.						
Boyd R.F., <i>General Microbiology</i> , 2 <sup>nd</sup> Edition, Times Mirrof/Mosby College Publishing St. Louis.1988.						
Bums, RG/&Slater JH; 1982, <i>Experimental Microbial Ecology</i> – Blackwell scientific Publications – Oxford London.						
Burges, A and Raw, F. 1967, <i>Soil Biology</i> , Academic Press, London.						
Harry Bukman and Nyle C. Brady, 1960: <i>The Nature and Properties of soil Eurasia</i> Pub House (Pvt) Ltd, New Delhi.						
Marshell K.C 1985, <i>Advances in Microbiology Ecology</i> Vol.8, Phenum Press						
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Define environmental studies and list the concept of Environmental studies</li> <li>➤ Evaluate the control measures of air, water and soil pollution</li> <li>➤ Construct the concept, structure and ecological pyramids of ecosystem</li> </ul>					





V SEMESTER					
Course code: 22BMI5C3	Core Course IX		T/P	C	H/W
	AGRICULTURAL MICROBIOLOGY		T	4	4
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To make the students understand the role of microbes in agriculture, plant microbe interaction and to know the importance of biofertilizers and biopesticides.</li> <li>➤ To review the current views of microbial association in various environments.</li> </ul>				
<b>Unit -I</b>	Classification, physical, chemical properties and structure of soil. Soil Microflora- Bacteria, Fungi and Actinomycetes. Rhizosphere and Phyllosphere. Microbial interactions – symbiosis, neutralism, mutualism commensalism, competition, amensalism, synergism, parasitism and predation.				
<b>Unit -II</b>	Microbial transformations of minerals- Carbon cycle, Nitrogen cycle – Nitrogen fixation, nitrification, de-nitrification, sulphur, iron and phosphorus cycles.				
<b>Unit -III</b>	Plant disease caused by bacteria: <i>Xanthomonas</i> , Mycoplasma, Spiroplasma. Fungi: Pyricularia, Phytophthora, <i>Fusarium</i> . Virus: TMV, CMV, Viroids – mechanism of pathogen of establishment and symptoms.				
<b>Unit -IV</b>	Definition and History of Biopesticides – Viral (NPV & CPV), bacterial ( <i>Bacillus thuringiensis</i> , and <i>Pseudomonas</i> sp.), Fungal ( <i>Beauveria</i> sp., <i>Metarrhizium</i> sp. & <i>Verticillium</i> sp.)				
<b>Unit -V</b>	Definition and History of Bio-fertilizer – Biological N <sub>2</sub> fixation, Diazotrophs, Associative symbiosis – Azospirillum, Azotobacter, Phospho bacteria, Mycorrhizae, VAM and Ecto & Endo – Mycorrhizae				
<b>Books for Reference:</b>					
Alexander, M 1977, <i>Introduction to Soil Microbiology</i> , John Wiley & Sons, inc. York.					
Boyd R.F., <i>General Microbiology</i> , 2 <sup>nd</sup> Edition, Times Mirrof/Mosby College Publishing St. Louis.1988.					
Burges, A and Raw, F. 1967, <i>Soil Biology</i> , Academic Press, London.					
Harry Bukman and Nyle C. Brady, 1960: <i>The Nature and Properties of soil</i> Eurasis Pub House (Pvt) Ltd, New Delhi.					
Martin-Alexander Wiley, 1961, <i>Introduction to Soil Microbiology International Ed</i> New York.					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Classify the application of microbes in agriculture field</li> <li>➤ Develop the agricultural management for uses in microbes</li> <li>➤ Understand the biogeochemical cycles prevail in environment.</li> </ul>				



V SEMESTER					
Course code: 22BMI5C4		Core Course X <b>MICROBIAL BIOTECHNOLOGY</b>	T/P <b>T</b>	C <b>4</b>	H/W <b>4</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To learn about the various enzymes involved in r DNA Technology</li> <li>➤ To know the principles of c DNA construction and amplification methods.</li> <li>➤ Making aware of synthesis of recombinant products</li> </ul>				
<b>Unit -I</b>	Genetic Engineering - Basic principles of rDNA technology, Restriction Enzymes - types, nomenclature, mechanism of action, Cloning vectors - Plasmid, pBR322, pUC18 and Bluescript, viral vectors–M13 and SV70, cosmid, phagmid, shuttle vectors and its application				
<b>Unit -II</b>	Methods in Biotechnology – cloning strategies - Isolation of genomic and plasmid DNA, construction of rDNA, transfer and screening of rDNA. Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, Blotting techniques - Southern, Northern, Western, Polymerase chain reaction – types, methods, application, DNA sequencing methods.				
<b>Unit -III</b>	Animal biotechnology– Antisense RNA technology, Culture medium – Serum medium, Serum free medium, complete medium, Primary cell culture – isolation, culture method, cell line – nomenclature, culture method, contact inhibition, maintenance, Human gene therapy – somatic and germ line therapy and its applications.				
<b>Unit -IV</b>	Plant Biotechnology – Plant tissue culture – culture medium – MS culture methods – callus, protoplast, meristem culture, embryo (somatic embryogenesis), Micropropagation, gene bombardment , biolistic technique. Agro-bacterium mediated gene transfer, Synthetic gene technology.				
<b>Unit -V</b>	Biosafety, bioethics and regulations - Biosafety Definition, Biosafety and Human health, Biosafety and environment, Biosafety of GEMS, Patent laws and IPR, BPM. Application of biotechnology in interferon, human growth hormone, insulin.				
<b>Books for Reference:</b>					
Brown,T.A. 2000.Gene Cloning, Fourth Edition, Chapman and Hall Publication, USA.					
Glick, B.K. and Pasternak, J.J. 2002. Molecular Biotechnology Principles and Applications of Recombinat DNA, ASM Press, Washington.					
Jogdan S.N, 1997, Gene Biotechnology, Himalaya Publishing House, New Delhi.					
Jogdand SN, 2005, Gene biotechnology. Himalaya Publishing House, Mumbai.					
Murugesan AG and Rajakumari C, 2005. Environmental Science and Biotechnology. First edition, MJP Publishers, Chennai.					
Primrose S.B, 2001, Molecular Biotechnology, 2 <sup>nd</sup> Edition, Panima Publishing Corporation, New Delhi.					
Purohit SS, Saluja AK, Kakrani HN, 2004, Pharmaceutical Biotechnology. First edition, Agrobios (India).					
Ramawat and Shaily goyal, 2010, Molecular biology and Biotechnology. First edition S. Chand & Co. Ltd., New Delhi.					
Satyanarayana, 2005, Biotechnology. First edition, Books and Allied (P) Ltd., Kolkata.					
Singh BD, 2005, Biotechnology. Second revised and enlarged edition, Kalyani Publishers, Chennai					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Students come out with basic ideas on cloning vehicle</li> <li>➤ Enable them to know about c DNA and amplification products.</li> <li>➤ Familiar in the construction of recombinant DNA.</li> </ul>				



<b>V SEMESTER</b>					
<b>Course code:</b> 22BMI5P1	Core Practical V		<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>MEDICAL MICROBIOLOGY</b>		<b>P</b>	<b>4</b>	<b>6</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To provide technical knowledge on collection and processing of clinical samples</li> <li>➤ To prepare them to work in clinical laboratory</li> </ul>				
<ol style="list-style-type: none"> <li>1. Examination of clinical samples – throat swab, pus, urine sample</li> <li>2. Enumeration of bacteria in Urine, quantitative Urine culture</li> <li>3. Antimicrobial sensitive testing and determination of MIC &amp; quality control.</li> <li>4. KOH Lacto phenol cotton blue preparation for skin scrapping for fungi.</li> <li>5. Stain for Malarial parasites –Giemsa stain.</li> <li>6. Identify bacteria (<i>E. coli</i>, <i>Bacillus</i>) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease and catalase tests</li> </ol>					
<b>Books for Reference:</b>					
<p>Anathanarayana and Paniker, Text Book of Microbiology Orient and Longman, New Delhi.</p> <p>Bailey and Scott's Diagnostic Microbiology by Baron et al.</p> <p>Jawetz Me hick, Adel berg Brooks, Butel and Orston, Medical Microbiology, Prentice Hail Incorporated London.</p> <p>Methods for General and Molecular Bacteriology (1997). Murray, R.G.F., Wood , W.A. and Krieg, N.B.</p>					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Get practical knowledge in specimen collection and processing</li> <li>➤ Become technically expert which will helpful to work in clinical laboratory</li> <li>➤ Able to identify clinical pathogens</li> </ul>				



<b>V SEMESTER</b>				
<b>Course code:</b> 22BMI5P2	<b>Core Practical VI</b>	<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>ENVIRONMENTAL MICROBIOLOGY</b>	<b>P</b>	<b>4</b>	<b>6</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To acquaint the student with various techniques used in environmental research in microbiology</li> <li>➤ To inculcate on environmental microbiology</li> </ul>			
	<ol style="list-style-type: none"> <li>1. Water quality analysis by MPN method</li> <li>2. Isolation of microbes from air sample technique- settle plate method</li> <li>3. Estimation of BOD from water sample.</li> <li>4. Estimation of COD from water sample.</li> <li>5. Isolation and counting of fecal bacteria from sewage water</li> <li>6. Determination of Dissolved Oxygen (DO) of water samples</li> <li>7. Isolation of <i>E. coli</i> from sewage water samples with the help of EMB agar medium</li> <li>8. Isolation and counting of fecal bacteria from sewage water</li> </ol>			
	<p><b>Books for Reference:</b></p> <p>Anathanarayana and Paniker, Text Book of Microbiology Orient and Longman, New Delhi.</p> <p>Bailey and Scott's Diagnostic Microbiology by Baron et al.</p> <p>Methods for General and Molecular Bacteriology (1997). Murray, R.G.F., Wood, W.A. and Krieg, N.B.</p> <p>Stanbury, P.F. Whitaker A and Hall S.J. Principles of Fermentation Technology, Elsevier Science limited Aditya Books Private Limited, New Delhi.</p>			
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Experience the research in the field of microbiology</li> <li>➤ Designing to overcome the environmental problems</li> <li>➤ Determine the experimental solution in future perspective</li> </ul>			



VI SEMESTER					
Course code: 22BMI6E1	DSE-I		T/P	C	H/W
	VIROLOGY		T	6	6
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ The course will teach the strategies by which viruses spread within a host, and are maintained within populations.</li> <li>➤ The students will be able to understand the basic principles and methods of classification of viruses.</li> </ul>				
<b>Unit -I</b>	Introduction: Definition of viruses. Concept of viroids, virusoids, satellite viruses and Prions. Theories of viral origin Structure of Viruses: Capsid symmetry, enveloped and non-enveloped viruses. Isolation, purification and cultivation of viruses				
<b>Unit -II</b>	Modes of viral transmission: Persistent, non-persistent, vertical and horizontal. Salient features of viral Nucleic acid : Unusual bases (TMV,T4 phage), overlapping genes (Hepatitis B virus), alternate splicing (HIV), terminal redundancy (T4 phage), terminal cohesive ends (lambda phage), partial double stranded genomes (Hepatitis B)				
<b>Unit -III</b>	Viral multiplication and replication strategies: Interaction of viruses with cellular receptors and entry of viruses. Replication strategies of viruses as per Baltimore classification (phi X 174, Retroviridae, Vaccinia, Picorna) , Assembly, maturation and release of virions				
<b>Unit -IV</b>	Introduction to oncogenic viruses. Types of oncogenic DNA and RNA viruses: Concepts of oncogenes and proto-oncogenes. Applications of Virology-Use of viral vectors in cloning and expression, Gene therapy and Phage display				
<b>Unit -V</b>	Prevention & control of viral diseases-Antiviral compounds and their mode of action Interferon and their mode of action. General principles of viral vaccination				
<b>Reference and Textbooks:-</b>					
Ananthanarayan.R. and Paniker C.K.J. 2020, <i>Text book of Microbiology</i> , orient Longman, 11 <sup>th</sup> Edition,					
Baijayanthi Mala Mishra, 2018, <i>Text book of Medical Virology</i> , CBS Publisher and Distributor Pvt. Limited.					
Paul Hyman & Stephen T. Adedon, Coasster, 2018, <i>Viruses of Microorganisms</i> , Academic Press,					
Paul Hyman & Srephen T. Abedon, 2018, <i>Viruses of microorganisms</i> , Caister academic Press,					
Paul G Western, MV Michael Valentine, 2016, <i>Essentials of Bacteriology</i> , Wentworth press,					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Define virology and discuss the concepts of structure and classification of virus</li> <li>➤ Illustrate knowledge on viral quantification methods</li> <li>➤ Deduct the Human viral infections - its pathogenesis and treatment</li> </ul>				



VI SEMESTER					
Course code: 22BMI6E2	DSE-II		T/P	C	H/W
	MYCOLOGY		T	6	6
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ This course will provide students with an overview of the major fungus diseases</li> <li>➤ This course will provide mycoses that threaten animal and human health</li> <li>➤ The causal agents, symptoms, modes of infections, prognosis, and treatment of fungus-related illness will be discussed</li> </ul>				
<b>Unit -I</b>	Introduction to Medical Mycology: Definitions and fungal terminology, fungal classification, historical overview-Zygomycota Ascomycota, Basidiomycota. Fungal life cycles. Impact of exposure on animal and human health to fungal toxins.				
<b>Unit -II</b>	Morphology, cultivation, epidemiology, transmission, clinical importance and lab diagnosis of: Yeasts, Yeast like, Moulds, Dimorphic fungus. Superficial mycoses: Pityriasis Versicolor; Tinea Nigra; Piedra.				
<b>Unit -III</b>	Cutaneous mycoses - various forms of Tinea and their causes, symptoms, and treatment: <i>Microsporum</i> spp., <i>Trichophyton</i> spp., and <i>Epidermophyton floccosum</i> .				
<b>Unit -IV</b>	Subcutaneous mycoses: Chromoblastomycosis; Phaeohyphomycosis; Sporotrichosis. Systemic Mycoses - caused by true pathogenic fungi: Blastomycosis; Paracoccidioidomycosis; Histoplasmosis.				
<b>Unit -V</b>	Opportunistic Infections - Candidiasis; Cryptococcosis; Aspergillosis. Fungal Allergies- Mushroom Poisonings & Mycotoxins. Antimycotic agents and treatment options.				
<b>Reference and Textbooks:-</b>					
Kavanagn. Fungi biology and application					
Arthur D. Introduction to mycology					
Chester W, Chapman H., Kwon-Chung., Medical mycology, third edition.					
Manual of basic techniques for a health laboratory 2 <sup>nd</sup> edition.					
Murre 5 <sup>th</sup> edition medical microbiology					
Sherris, Medical microbiology ,an introduction to infection					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Upon successful completion of this course, the student will be aware about the different genera and species of fungi.</li> <li>➤ Acquire knowledge on life cycles, pathogen genera and the different ways to control these diseases as beside the fungal pesticides</li> </ul>				



VI SEMESTER					
Course code: 22BMI6E3	DSE-III		T/P	C	H/W
	MICROBIAL TECHNOLOGY		T	6	6
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To acquire knowledge on food product analysis</li> <li>➤ To enable them to know about preservation of pharmaceutical products</li> <li>➤ Learn to assess the microbial quality of marine foods.</li> </ul>				
<b>Unit -I</b>	Mineral water industry: Stages of mineral water production. Analysis of water quality – pH, salinity, alkalinity, dissolved oxygen, carbonates, nitrate, silicate, phosphate, COD and BOD. Determination of microbial load in water.				
<b>Unit -II</b>	Preservation of pharmaceutical Products: Chemical preservatives – raw materials – equipment – role of preservatives. Finished product tests – microbial enumeration test, tests for specified microorganisms.				
<b>Unit -III</b>	Endotoxin test methods: gel clot assay, turbidometric assay. Biological assays - vitamin assay, antibiotic susceptibility testing-Disc diffusion. Endotoxin activity – risk assessment in parenterals manufacture – pyrogen test – depyrogenation methods.				
<b>Unit -IV</b>	Rapid methods for detection of microorganisms in food: conventional and automated. Application of light pulse technology. Quality control in fruits and vegetable processing. Risk assessment in food industry – physical, chemical and biological hazards.				
<b>Unit -V</b>	Assessment of microbial quality of marine foods: Conventional and recent development methods – flow cytometry, ATP estimation, radiometric, reflective colorimetry, LAL test, immunoassay, DNA based and microarray methods.				
<b>Reference and Textbooks:-</b>					
Ashutosh, K. (2008). <i>Pharmaceutical Microbiology</i> . New Delhi: New Age International Publishers.					
Kevin, W. (2007). <i>Endotoxins – Pyrogens, LAL Testing and Depyrogenation</i> (3rd ed). Informa Press.					
Manivasakam, N. (2001). <i>Chemical and Microbial analysis of mineral and packaged drinking waters</i> . Coimbatore: Sakthi Book Service.					
Trivedy, R.K., Goel, P.K. and Trishal, C.L. (1987). <i>Practical methods in Ecology and Environmental science</i> . Environmental publishers.					
John A. J. Barbara, Fiona A. M. Regan, Marcela Contreras. (2008). <i>Transfusion Microbiology</i> , United Kingdom: Cambridge University Press.					
Joseph, A. Bellanti. (2016). <i>Immunology IV: Clinical Applications in Health and Disease</i> . Washington, DC: Georgetown University School of Medicine.					
Michael J. Day, Ronald D. Schultz. (2014). <i>Veterinary Immunology: Principles and Practice</i> (2 <sup>nd</sup> ed). CRC Press.					
Raif Geha, Luigi Notarangelo. (2016). <i>Case Studies in Immunology. A Clinical Companion</i> (7 <sup>th</sup> ed). ASM Press.					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Acquire Knowledge on food product analysis</li> <li>➤ Impart knowledge of preservation technology.</li> <li>➤ Knowledge on quality analysis of marine food products</li> </ul>				



<b>VI SEMESTER</b>				
<b>Course code:</b> 22BMI6E4	<b>DSE-IV</b>	<b>T/P</b>	<b>C</b>	<b>H/W</b>
	<b>BIOSAFETY, IPR AND BIOETHICS</b>	<b>T</b>	<b>6</b>	<b>6</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To discuss about various aspects of biosafety regulations</li> <li>➤ To discuss about IPR and bioethic concerns arising from the commercialization of bio-products.</li> <li>➤ To learn, understand and analyse the Laws and Relations relating to IPR</li> </ul>			
<b>Unit -I</b>	Biosafety and risk assessment issues; Regulatory framework; National biosafety policies and law, The Cartagena protocol on biosafety, WTO, Cross border movement of germplasm; Risk management issues - containment			
<b>Unit -II</b>	General principles for the laboratory and environmental biosafety; Health aspects; toxicology, allergenicity, antibiotic resistance, etc; Impact on environment: gene flow in natural and artificial ecologies; Sources of gene escape, tolerance of target organisms, creation of superweeds/superviruses, etc.			
<b>Unit -III</b>	Ecological aspects of GMOs and impact on biodiversity; Monitoring strategies and methods for detecting transgenics; Radiation safety and nonradio isotopic procedure; Benefits of transgenics to human health, society and the environment.			
<b>Unit -IV</b>	Intellectual properties, copyrights, trademarks, trade secrets, patents, geographical indications, etc; Protection of plant variety and farmers right act			
<b>Unit -V</b>	Indian patent act and amendments, patent filing; Convention on biological diversity; Implications of intellectual property rights on the commercialization of biotechnology products.			
<b>Reference and Textbooks:-</b>				
Sateesh, M.K., Bioethics and Biosafety, IK International Publishers (2008)				
Singh I. and Kaur, B., Patent law and Entrepreneurship, Kalyani Publishers (2006).				
Srinivasan, K. and Awasthi, H.K., Law of Patents, Jain Book Agency (1997)				
Narayan, P., Patent Law, Eastern Law House (1975).				
Jonathan, Y.R., Anthology of Biosafety (Vols. 1-4), American Biological Safety Association (2005).				
Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons Inc. (2005).				
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Interpret basics of biosafety and bioethics and its impact on all the biological sciences and the quality of human life</li> <li>➤ Recognize importance of biosafety practices and guidelines in research</li> <li>➤ Recognize importance of protection of new knowledge and innovations and its role in business</li> </ul>			





VI SEMESTER					
Course code: 22BMI6E5		DSE-V	T/P	C	H/W
		INDUSTRIAL MICROBIOLOGY	T	6	6
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To development the microbial strains for large scale production and product recovery.</li> <li>➤ To learn about fermentation types</li> <li>➤ To understand the extraction and purification of fermented products</li> </ul>				
<b>Unit -I</b>	Brief history and developments of industrial microbiology - Isolation of industrially important microbial strains, identification and classification of industrially important microorganisms, primary and secondary screening, strain improvement, and immobilization.				
<b>Unit -II</b>	Types of fermentations – batch, fedbatch and continuous fermentation, Media for industrial fermentations – crude and synthetic media. Ingredients - carbon, nitrogen, vitamin and mineral sources, role of buffers, precursors, inhibitors, inducers and antifoams, Sterilization – instruments, medium and air.				
<b>Unit -III</b>	Bioreactors / fermenters – components (design) of typical fermenter, types of fermenters – fermenters for microbial and animal cell culture, Measurement and control of fermentation parameters – control and monitoring of different parameters in a fermenters – pH, temperature, dissolved oxygen, foaming and aeration and computer automation.				
<b>Unit -IV</b>	Down-stream processes – filtration, centrifugation, cell disruption, solvent extraction, precipitation, chromatography, ultra filtration, lyophilizaion and spray drying.				
<b>Unit -V</b>	Microbial production of industrial products – citric acid, ethanol, cellulose and wine. Enzyme immobilization – methods of immobilization, advantages of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).				
<b>Books for Reference:</b>					
<p>Agrawal AK &amp; Pradeep Parihar, 2006, <i>Industrial Microbiology</i>. Student edition, Jodhpur.</p> <p>Casida L.E, 1968, (Reprint2008) <i>Industrial Microbiology</i>, Wiley Eastern Ltd, New Delhi.</p> <p>Demain AL., AL and Solman, NA, 1996, <i>Manual of Industrial Microbiology</i>, American Society of Microbiology, Washington DC.</p> <p>Hugo WB and AD Russel, 1998, <i>Pharmaceutical Microbiology</i>. Sixth edition, Black Well Scientific Company Ltd.</p> <p>Old R.W &amp; Primrose S.B, 2006, Principles of gene manipulation, 7<sup>th</sup> Edition, Blackwell Scientific, London.</p> <p>Patel A.H ,1985, (reprint 1996), <i>Text book of industrial microbiology</i>, MacMillan India Ltd</p> <p>Purohit SS, Saluja AK, Kakrani HN, 2004, <i>Pharmaceutical Microbiology</i>. First edition, Agrobios (India).</p> <p>Russell and Ayliffe, G.A.J, 1982), Principles and practice of Disinfection, preservation and sterilization Oxford.</p> <p>Sivakumar PK, Joe MM and Sukesh K, 2010, <i>An introduction to Industrial Microbiology</i>. First edition, S.Chand &amp; Company Ltd, New Delhi.</p> <p>Stansbury, P.R. and Whittaker A, 1987 <i>Principles of fermentation technology</i>, Pergamon Press, Oxford.</p>					
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Define the type of industrial microbes and list the industrially important microbes</li> <li>➤ Interpret the concepts of upstream and downstream processing of fermentation technology</li> <li>➤ Investigate on the production of economical important microbial products</li> </ul>				



VI SEMESTER				
Course code: 22BMI6E6	DSE-VI	T/P	C	H/W
	FOOD MICROBIOLOGY	T	6	6
<b>Objectives</b>	<ul style="list-style-type: none"> <li>➤ To understand fermentation technologies and food quality analysis based on government organizations involved in food quality control.</li> <li>➤ To overview the food spoilage organisms, infection process and their outbreaks.</li> </ul>			
<b>Unit -I</b>	Food as a substrate for microorganisms, Microorganisms important in food Microbiology - bacteria, yeast, moulds, Factors influencing microbial growth in food, Contamination of foods, General principles underlying spoilage – chemical changes caused by microorganisms.			
<b>Unit -II</b>	Food Preservation – Physical Methods – Asepsis, drying, heat processing, Filtration, chilling and freezing, Radiation, Pasteurization, Desiccation, Anaerobiosis, Canning controlled Atmosphere. Chemical Preservatives – Salt, Sugar, Organic acid (Benzoic acid, Sorbic acid, Propionates, Acetic acid & Lactic acid), Nitrites, Nitrates, Sulphur dioxide, Ethylene dioxide, Propylene acid, Wood Smoker and Antibiotics.			
<b>Unit -III</b>	Rapid methods for detection of microorganisms in food: conventional and automated. Application of light pulse technology – principles of light pulse generation, mode of action, equipments, application of light pulses, effect of light pulses on foods and microorganisms, advantage and limitation of light pulse treatment.			
<b>Unit -IV</b>	Contamination and Spoilage of different groups of Foods–Cereals and Cereal Products, Vegetables and fruits, Meat and Meat products, Eggs and Poultry, Fish, Canned Food- Botulism.			
<b>Unit -V</b>	Food borne diseases – Bacterial and Viral food borne diseases, food – borne important animal parasites, Mycotoxins, Indicators of food safety and Quality, Microbiological Criteria of foods and their significance, Role of microbes in fermented foods – beverages, Curd, Butter milk, Toddy foods and Traditional foods.			
<b>Books for Reference:</b>				
<p>Adams MR &amp; Moss MO, 1995, <i>Food Microbiology</i>, New Age International P. Ltd. Publications.</p> <p>Atlas R.M, 1997, <i>Principles of Microbiology</i>, 2<sup>nd</sup> edition, WCB/McGraw Hill, New York</p> <p>Banwart G.J, 2007, <i>Basic Food Microbiology</i>, 2<sup>nd</sup> Edition, CBS Publishers &amp; Distributors, New Delhi.</p> <p>Michael J. Pelczar I.R., Chan E.C.S and Noel R. Krieg, 2007, <i>Microbiology</i>, 5<sup>th</sup> edition, Tata McGraw-Hill, New Delhi.</p> <p>Sivashankar B – Moss, 2011, <i>Food Processing and Preservation</i>. Eighth edition, PHI Learning P.Ltd., New Delhi.</p> <p>Vijaya Ramesh K, 2007, <i>Food Microbiology</i>. First edition, MJP Publishers, Chennai.</p> <p>Wood J.B, 1998, <i>Microbiology of fermented foods</i>, Volumes I and II, 2<sup>nd</sup> edition, Elsevier Applied Science Publishers, London, England.</p>				
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>➤ Define the food microbiology and outline the general principles of food Microbiology</li> <li>➤ Classify the economically important of Bacteria, Yeast and Mold</li> <li>➤ Find the pathogenic organisms involved in the spoilage &amp; normal flora of the food</li> </ul>			



VI SEMESTER					
Course code: 22BMI6E7	DSE-VII		T/P	C	H/W
	DAIRY MICROBIOLOGY		T	6	6
Objectives	<ul style="list-style-type: none"> <li>➤ To understand microbiology of processed dairy foods</li> <li>➤ To understand significance of different dairy microorganisms, their control and other related aspects</li> </ul>				
Unit -I	Introduction and significance of dairy microbiology, sources of contamination in milk, hygienic milk production, Microbial changes in milk during production and processing, mastitis.				
Unit -II	Morphology and classification of dairy bacteria-Lactic acid bacteria- <i>Lactococcus</i> , <i>Streptococcus</i> , <i>Lactobacillus</i> , <i>Bifidobacterium</i> . Role of psychrotrophic, mesophilic, thermophilic and thermotolerants in spoilage of milk. Effect of processing on microorganisms in milk.				
Unit -III	Infections, toxi-infections and pathogens associated with milk and milk products and their preservations. Microbiological methods of milk testing.				
Unit -IV	Starter cultures of fermented milks- Dahi, Lassi, Yoghurt, Acidophilus milk, cultured buttermilk. Starter cultures of cheeses, microbiology of fresh and ripened cheeses, accelerated cheese ripening. Microbial Production of cheese and yoghurt.				
Unit -V	Microbiological standards and quality of dairy products –cream, butter, dried and evaporated milk, sweetened condensed milk. Microbiological spoilage and safety of fermented dairy products. Mechanism of action of probiotics and their health benefits and regulations.				
<b>Books for Reference:</b>					
Bensaon H.J, 1990, <i>Microbiological applications</i> , 5th edition, Crown Publishers, USA.					
Frazies, W.C. & Westhoff, D.C, 1988, <i>Food microbiology</i> . 4 <sup>th</sup> Edition. McGraw Hill NY.					
Michael J. Pelczar I.R., Chan E.C.S and Noel R. Kreieg, 2007, <i>Microbiology</i> , 5 <sup>th</sup> edition, Tata McGraw-Hill, New Delhi.					
Robinson R.K., 1990, Dairy Microbiology. Elsevier Applied science, London					
Sivashankar B – Moss, 2011, <i>Food Processing and Preservation</i> . Eighth edition, PHI Learning P.Ltd., New Delhi.					
Vijaya Ramesh K, 2007, <i>Food Microbiology</i> . First edition, MJP Publishers, Chennai.					
Wood J.B, 1998, <i>Microbiology of fermented foods</i> , Volumes I and II, 2 <sup>nd</sup> edition, Elsevier Applied Science Publishers, London, England.					
Outcomes	<ul style="list-style-type: none"> <li>➤ Detect food poisoning causing microbes and perform the tests to determine quality control of dairy product (milk)</li> <li>➤ Better understanding of cause of microbes in food spoilage</li> <li>➤ Get information regarding food preservation techniques</li> </ul>				

