



# **NEHRU ARTS AND SCIENCE COLLEGE**

(An Autonomous Institution affiliated to Bharathiar University)

(Reaccredited with "A" Grade by NAAC, ISO 9001:2015 & 14001:2004 Certified)

Recognized by UGC with 2(f) & 12(B), Under Star College Scheme by DBT, Govt. of India)

Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105, Tamil Nadu.



# **B. Sc Biotechnology**

**(Academic year 2022 – 2023)**

# **CURRICULUM**



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Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105, Tamil Nadu.



## Scheme of Examination

### B. Sc. Biotechnology

(Applicable to the students admitted during the academic year 2022-2023 onwards)

Semester	Part	Course Code	Name of the Course	Instruction hours / week	Duration of Examination	Examination Marks			Credits	
						CIA	ESE	Total		
I	I	21U1TAM101 21U1HIN101 21U1MAL101 21U1FRN101	Language – I	5	3	50	50	100	4	
		II	21U2ENG101	English – I	5	3	50	50	100	4
		III	22U3BTC101	Core Paper – I Cell Biology and Histology	4	3	50	50	100	4
			22U3BTC102	Core Paper – II Biotechniques and Instrumentation	4	3	50	50	100	4
	22U3BTP204		Core Paper – IV Biotechniques and Microbiology Practical	3	-	-	-	-	-	
	21U3BTA101/ 22U3BTA101		Allied Paper – I Chemistry – I	4	3	30	45	75	3	
	IV	21U3BTR203/ 22U3BTR203	Allied Paper – III Chemistry Practical	2	-	-	-	-	-	
		21U4ENV101	Ability Enhancement Compulsory Course - Environmental Studies	2	3	50	-	50	2	
			21U4HVY201	Value Education -Human Values and Yoga Practice – I	1	-	-	-	-	
					<b>30</b>				<b>525</b>	<b>21</b>
II	I	21U1TAM202 21U1HIN202 21U1MAL202 21U1FRN202	Language – II	5	3	50	50	100	4	
		II	21U2ENG202	English – II	5	3	50	50	100	4
	III	22U3BTC203	Core Paper – III Fundamentals of Microbiology	4	3	50	50	100	4	
		22U3BTP204	Core Paper – IV Biotechniques and Microbiology Practical	5	3	50	50	100	4	
		22U3BTA202	Allied Paper – II Chemistry – II	4	3	30	45	75	3	
		21U3BTR203/ 22U3BTR203	Allied Paper – III Chemistry Practical	4	3	25	25	50	2	

	IV	21U4HRC202	Ability Enhancement Compulsory Course – Human Rights and Constitution of India	2	3	50	-	50	2	
		21U4HVY201	Value Education -Human Values and Yoga Practice – I	1	2	50	-	50	2	
				<b>30</b>				<b>625</b>	<b>25</b>	
III	I	21U1TAM303 21U1HIN303 21U1MAL303 21U1FRN303	Language – III	5	3	50	50	100	4	
		II	21U2ENG303	English – III	5	3	50	50	100	4
		III	21U3BTC305	Core Paper – V Biochemistry and Metabolism	4	3	50	50	100	4
			21U3BTP407	Core Paper – VII Biochemistry and Human Physiology Practical	3	-	-	-	-	-
	21U3BTA304		Allied Paper – IV Programming in C	3	3	30	45	75	3	
	21U3BTR406		Allied Paper – VI C Programming Practical	2	-	-	-	-	-	
	IV	21U4BTS301	Skill Based Paper – I Human Physiology and Disorders	3	3	30	45	75	3	
	IV	21U4NM3BT1 / 21U4NM3AT1 / 21U4NM3CAF/ 21U4NM3GTS/ 21U4NM3WRT	# @Basic Tamil - I / ##Advanced Tamil - I / * NME: Consumer Affairs / Gandhian Thoughts / Women’s Rights	2	2	50		50	2	
		21U4BT3ED1/ 21U4BT3ED2	Extra Departmental Course	2	3	-	50	50	2	
		21U4HVY402	Value Education –Human Values and Yoga Practice – II	1	-	-	-	-	-	
		21U4BTVALC	**Skill Enhancement Add on course-Institute Industry Linkage	-	-	-	-	-	-	
				<b>30</b>				<b>550</b>	<b>22</b>	
	IV	I	21U1TAM404 21U1HIN404 21U1MAL404 21U1FRN404	Language – IV	5	3	50	50	100	4
II			21U2ENG404	English – IV	5	3	50	50	100	4
III			21U3BTC406	Core Paper –VI Biosafety and IPR	4	3	50	50	100	4
			21U3BTP407	Core Paper – VII Biochemistry and Human Physiology Practical	4	3	50	50	100	4
		21U3BTA405	Allied Paper –V Biostatistics	3	3	30	45	75	3	
		21U3BTR406	Allied Paper – VI C- Programming Practical	2	3	25	25	50	2	
IV		21U4BTS402	Skill Based Paper – II Bioinformatics and Computational Biology	4	3	30	45	75	3	
		21U4NM4BT2 21U4NM4AT2 21U4NM4GEN	# @Basic Tamil - II/ ##Advanced Tamil - II / General Awareness	2	3	50		50	2	
		21U4HVY402	Value Education – Human Values and Yoga Practice – II	1	2	50	-	50	2	
		21U4BTVALC	**Skill Enhancement	-	-	-	-	-	Grade	

			Add on course-Institute Industry Linkage							
				<b>30</b>				<b>700</b>	<b>28</b>	
V	III	21U3BTC508	Core Paper –VIII Microbial Biotechnology	5	3	50	50	100	4	
		21U3BTC509	Core Paper – IX Immunology	5	3	50	50	100	4	
		21U3BTC510	Core Paper – X Recombinant DNA Technology	5	3	50	50	100	4	
		21U3BTP613	Core Paper – XIII Microbial, Plant & Animal Biotechnology Practical	4	-	-	-	-	-	
		21U3BTP614	Core Paper – XIV Immunology and rDNA Technology Practical	4	-	-	-	-	-	
		21U3BTE501/ 21U3BTE502/ 21U3BTE503	Discipline Specific Elective Paper – I	4	3	50	50	100	4	
	IV	21U4BTS503	Skill Based Paper – III Molecular Biology	3	3	30	45	75	3	
				<b>30</b>				<b>475</b>	<b>19</b>	
VI	III	21U3BTC611	Core Paper – XI Plant Biotechnology	5	3	50	50	100	4	
		21U3BTC612	Core Paper – XII Animal Biotechnology	5	3	50	50	100	4	
		21U3BTP613	Core Paper – XIII Microbial, Plant and Animal Biotechnology Practical	4	6	50	50	100	4	
		21U3BTP614	Core Paper – XIV Immunology and rDNA Technology Practical	4	6	50	50	100	4	
		21U3BTE604/ 21U3BTE605/ 21U3BTE606	Discipline Specific Elective Paper – II	4	3	50	50	100	4	
		21U3BTE607/ 21U3BTE608/ 21U3BTE609	Discipline Specific Elective Paper – III	4	3	50	50	100	4	
		IV	21U4BTS604	Skill Based Paper –IV Pharmacology	4	3	30	45	75	3
		V	21U5EXT601	Extension Activities	-	-	50	-	50	2
				<b>30</b>				<b>725</b>	<b>29</b>	
<b>Total</b>								<b>3600</b>	<b>144</b>	

# **Basic Tamil** -Students who have not studied Tamil upto 12<sup>th</sup> standard.

##**Advanced Tamil** – Students who have studied Tamil language upto 12<sup>th</sup>/ 10<sup>th</sup> standard and have chosen other languages under part I of the programme but would like to advance their Tamil language skills.

\* **NME** – Students shall choose any one course out of three courses.

@ No End Semester Examinations. Only Continuous Internal Assessment (CIA)

\$ Not included in CGPA calculation

\*\* Examination and Evaluation for Value Added Course shall be conducted by the Industry and the marks shall be submitted to the CoE section for the award of Grade

<b>Elective</b>	<b>Course Code</b>	<b>Group</b>	<b>Name of the Course</b>
Elective – I	21U3BTE501	A	Biotechnology and Food Safety
	21U3BTE502	B	Medical Biotechnology
	21U3BTE503	C	Agricultural Biotechnology
Elective – II	21U3BTE604	A	Food Processing Technology
	21U3BTE605	B	Molecular Modeling and Drug Design
	21U3BTE606	C	Bioremediation
Elective – III	21U3BTE607	A	Quality Control and Assurance
	21U3BTE608	B	Stem Cell Research
	21U3BTE609	C	Nanoscience and Technology

**LIST OF DISCIPLINE SPECIFIC ELECTIVE PAPERS:**

**Extra Departmental Course offered by Biotechnology Department to other Department students**

<b>S. No.</b>	<b>Semester</b>	<b>Course Code</b>	<b>Name of the Course</b>
1	III	21U4BT3ED1	Apiculture
2		21U4BT3ED2	Organic Terrace Farming

**Self Study Paper offered by Biotechnology Department**

<b>S. No.</b>	<b>Semester</b>	<b>Course code</b>	<b>Course Title</b>
1	Semester II to V	21UBTSS01	Hematology
2		21UBTSS02	Histology

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**Board of Studies in Biotechnology**  
**Nehru Arts and Science College**  
**Coimbatore**

Course Code		Title	
22U3BTC101		Core Paper – I Basics of Cytology	
Semester: I		Credits:4	CIA: 50 Marks
ESE: 50 Marks			
Course Objective	To understand the fundamental components in cells, its functions and essentials in histology		
Course Category	Skill Development		
Development Needs	Global		
Course Description	Develop the skills of structure and functions of Prokaryotic and Eukaryotic cells		
Course Outcomes		Teaching Methods	Assessment Methods
CO 1	Understand the structural uniqueness of prokaryotic and eukaryotic cells	Lecture	Assignment
CO 2	Develop knowledge on specific mechanism of various cell components and reproduction	Video Lecture	Quiz
CO 3	Identify special features of the specific cells	Models	Models
CO 4	Understand cell communication	Video Lecture	Quiz
CO 5	Able to differentiate Tissue sections	Project	Practical
Offered by	Biotechnology		
Course Content		Instructional Hours / Week : 4	
Unit	Description	Text Book	Chapters
I	<b>Cell as a basic unit:</b> Discovery of the cells, classification of cell types, development of cell theory, early chemical investigation in cell biology. Prokaryotic and Eukaryotic cell organization.	1	1, 2
<b>Instructional Hours</b>			<b>10</b>
<b>Suggested Learning Methods: Lecture on basic of cell organization</b>			<b>02 Hrs</b>
II	<b>Cell transport phenomenon:</b> Membrane architecture. Active, Passive, diffusion and osmosis. <b>Cell division in prokaryotes and eukaryotes:</b> Cell cycle, mitosis, meiosis, crossing over and characteristics of cancer. Apoptosis, Stem cell, Prions.	2	11, 17
<b>Instructional Hours</b>			<b>10</b>
<b>Suggested Learning Methods: Video Lecture on cellular transport and cell division</b>			<b>02 Hrs</b>
III	<b>Structure and function of cytoplasmic compartments of the cell:</b> Ribosome and protein synthesis, energy flow through mitochondrion, chloroplast and photosynthesis, Golgi apparatus, lysozymes and micro bodies, endoplasmic reticulum, vacuoles, peroxysomes, lysosomes and nuclear compartment. Heterochromatin and euchromatin, polytene chromosomes.	3	2
<b>Instructional Hours</b>			<b>10</b>
<b>Suggested Learning Methods: Study of cell organelles by 3D Models</b>			<b>02 Hrs</b>
IV	<b>Cell communication &amp; Specialized cells:</b> Integrative and specialized cellular events, cell-cell signaling. Nerve cells, sperm cells, micro-filaments, microtubules, muscle cells. Cells of vision, Nucleo-cytoplasmic interaction, cell cloning.	4	6
<b>Instructional Hours</b>			<b>10</b>
<b>Suggested Learning Methods: Video Lecture to show cell communication</b>			<b>02 Hrs</b>
V	<b>Basics of Histology:</b> Preparation of tissues for study, microscopy, autoradiography, Enzyme histochemistry, visualizing specific molecules, interpretation of structures in tissue sections and type of Immunohistology.	4	1
<b>Instructional Hours</b>			<b>10</b>
<b>Suggested Learning Methods : Demo class on interpretation of structures</b>			<b>02 Hrs</b>
<b>Total Hours</b>			<b>60 Hrs</b>

<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Gerald Karp, Cell Biology, Wiley Publications, 7th Edition, 2013.</li> <li>2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter, Molecular Biology of the Cell, Garland Science, New York, 2002.</li> <li>3. De Robertis and De Robertis, Cell and Molecular Biology, W B Saunders Co., 8th Edition, 2010.</li> <li>4. Anthony L. Mescher, Junqueira's Basic Histology – Text and Atlas, The McGraw-Hill Companies, 14th Edition., 2016</li> </ol>												
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Philip Sheeler and Donald E Bianchi, Cell and Molecular Biology, John Wiley, 3<sup>rd</sup> edition, 1987.</li> <li>2. Lodish Baltimore, Molecular Cell Biology, Scientific American books, 5<sup>th</sup> Edition, 2008.</li> <li>3. Stephen L Wolfe, Molecular and Cell Biology, Wadsworth Publishing Company, 1993.</li> <li>4. Arthur Clarkson, A Text - Book of Histology- Descriptive and Practical, Bristol: John White &amp; Co., London, 1896.</li> <li>5. Patrice F Spitalnik, Histology Laboratory Manual, College of Physicians and Surgeons Columbia University, 2016-2017.</li> </ol>												
<b>Web. URLs</b>	web.nchu.edu.tw/pweb/users/taiwanfir/lesson/1146.pdf												
<b>Tools for Assessment (50 Marks)</b>													
<b>CIA I</b>	<b>CIA II</b>	<b>CIA III</b>	<b>Assignment</b>	<b>Seminar</b>	<b>Quiz</b>	<b>Total</b>							
8	8	10	8	8	8	50							
<b>Mapping</b>													
<b>CO \ PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	H	L	H	M	M	M	M	H	M	H	M	L	M
<b>CO2</b>	H	L	H	M	M	M	H	M	L	M	M	H	M
<b>CO3</b>	M	M	M	M	M	H	-	M	M	M	H	M	M
<b>CO4</b>	H	M	H	M	M	M	H	M	H	M	M	M	H
<b>CO5</b>	H	M	H	-	M	M	M	M	M	M	M	M	H
H-High; M-Medium; L-Low													
<b>Course designed by</b>							<b>Verified by</b>						
M. DHANALAKSHMI, BIOTECHNOLOGY							N. SARANYA						



22U3BTC102		Core Paper – II Biotechniques and Instrumentation		
Semester: I		Credits: 4	CIA: 50 Marks	ESE:50 Marks
<b>Course Objective</b>		To provide a theoretical knowledge on basic analytical tools to study the structure and function of bio molecules		
<b>Course Category</b>		Skill Development / Employability		
<b>Development Needs</b>		Global		
<b>Course Description</b>		The course was designed to provide an overview, principle and applications of instrumentation systems used in biological and medical research		
Course Outcomes		Teaching Methods	Assessment Methods	
<b>CO 1</b>	Discuss the basic principles and applications of bio instruments	Virtual	Assignment	
<b>CO 2</b>	Describe the concept and principles of spectroscopy	Video lessons	Seminar	
<b>CO 3</b>	Learn to apply the techniques in order to separate and purify macro molecules	Demonstration	Quiz	
<b>CO 4</b>	Design the techniques to be applied for immunological analysis	Virtual	Discussion	
<b>CO 5</b>	Employ the florescent techniques for in-vitro and in-vivo studies	Lecture	Decision making	
<b>Offered by</b>	Biotechnology			
<b>Course Content</b>		<b>Instructional Hours / Week : 4</b>		
Unit	Description	Text Book	Chapters	
<b>I</b>	<b>Basic Bioinstruments</b> : Principle, types and applications of pH meter, Centrifuge (Analytical and preparative), Laminar Air Flow, Autoclave, Hot Air Oven and Incubator	1	3	
			<b>Instructional Hours</b>	<b>10</b>
<b>Suggested Learning Methods : Video lectures</b>			<b>02 Hrs</b>	
<b>II</b>	<b>Spectroscopy:</b> Colorimeter, UV-Visible spectrometry, Mass spectrometry, circular dichroism spectroscopy and Falme photometer.	1	12	
			<b>Instructional Hours</b>	<b>10</b>
<b>Suggested Learning Methods : Adaptive learning</b>			<b>02 Hrs</b>	
<b>III</b>	<b>Separation and Purification of Biomolecules:</b> principle of Paper, Thin Layer, gel filtration, Ion exchange, affinity chromatography and its applications. Electrophoresis Techniques: AGE, PAGE, SDS PAGE	1	10&11	
			<b>Instructional Hours</b>	<b>10</b>
<b>Suggested Learning Methods : Inquiry based learning</b>			<b>02 Hrs</b>	
<b>IV</b>	<b>Immunochemical Techniques:</b> Antibody production, Immunoprecipitation, Antibodylabelling, Immunoassay, immunohistochemistry	1,2	7,4	
			<b>Instructional Hours</b>	<b>10</b>
<b>Suggested Learning Methods : Interactive learning</b>			<b>02 Hrs</b>	

V	<b>Fluorescent Techniques:</b> Principles of fluorescence, bioluminescence and phosphorescence FRET, Florescent labeling and applications, Florescent microscopy, Flow cytometry and Luminometer			3	13&14								
<b>Instructional Hours</b>					10								
<b>Suggested Learning Methods : Kinesthetic learning</b>					<b>02 Hrs</b>								
<b>Total Hours</b>					60 Hrs								
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Kith Wilson and Johnwalker, <b>Principles and Techniques of Biochemistry and Biology</b>, 7<sup>th</sup> Edition, 2010.</li> <li>2. John G. Webster, <b>Bioinstrumentation</b>, John Wiley &amp; Sons, 2007. Arumugam M., <b>Biomedical Instrumentation</b>, Anuradha Publications, 10<sup>th</sup> Edition, 2006. Unit I: Text Book 1, Chapter 3 Unit II: Text Book 1, Chapter 12. Unit III: Text Book 1, Chapter 10&amp;11 Unit IV: Text Book1, 2, Chapter 7 Unit V:Text Book 3, Chapter 3&amp;14</li> </ol>												
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>3. Sawhney S. K. and Randhir Singh, <b>Introductory Practical Biochemistry</b>, Narosa Publishing House, 2000.</li> <li>4. Gedder A and L. E. Balsar, <b>Principles of Applied Biomedical Instrumentation</b>, John Wiley and Sons, 2009.</li> <li>5. Boyer, Rodney F. Benjamin and Cummins, <b>Modern Experimental Biochemistry</b>, 2<sup>nd</sup> Edition, 1993.</li> </ol>												
<b>Web. URLs</b>	<a href="http://www.itl.nist.gov/div898/handbook/prisection3/pri3.htm">http://www.itl.nist.gov/div898/handbook/prisection3/pri3.htm</a> (online e book) <a href="http://www.statease.com/de7_man.html">http://www.statease.com/de7_man.html</a> (Software Tutorial Website)												
<b>Tools for Assessment (50 Marks)</b>													
<b>CIA I</b>	<b>CIA II</b>	<b>CIA III</b>	<b>Assignment</b>	<b>Seminar</b>	<b>Quiz</b>	<b>Total</b>							
<b>8</b>	<b>8</b>	<b>10</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>50</b>							
<b>Mapping</b>													
<b>CO \ PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	M	L	H	L	L	L	L	H	H	L	H	M	H
<b>CO2</b>	H	M	M	M	L	M	L	M	H	M	L	M	H
<b>CO3</b>	H	M	H	M	M	M	M	H	M	M	M	L	M
<b>CO4</b>	H	M	H	M	M	M	M	H	M	M	H	M	L
<b>CO5</b>	H	M	M	M	H	M	H	M	H	M	M	M	M
H-High; M-Medium; L-Low													
<b>Course designed by</b>							<b>Verified by</b>						
P. SENTHILKUMAR, BIOTECHNOLOGY							N. SARANYA						

Course Code		Title		
21U3BTA101/ 22U3BTA101		Allied Paper – I Chemistry – I		
Semester: I		Credits: 4	CIA : 30 Marks	ESE: 45 Marks
Course Objective	To realise the importance of basics in assemblage of small molecules and to utilise in retrieving meaningful conclusion through problem based learning			
Course Category	Skill Development / Employability			
Development Needs	Regional			
Course Description	It elaborates basic structure of organic molecule, prediction of chemical properties and feasibility of reactions.			
Course Outcomes		Teaching Methods	Assessment Methods	
CO 1	Know the basics in structure and reactions of organic molecules	Experiential learning	Seminar	
CO 2	Understand the importance of chemical kinetics	Experiential learning	Problem	
CO 3	Retrieve meaningful conclusion from thermodynamic parameters	Experiential learning	Problem	
CO 4	know the limitations of each concepts and looking for an alternatives in analysis	Activity based learning	Assignment	
CO 5	Know the importance of electrochemistry in analysis	Lecture method	Assignment	
Offered by	Biotechnology			
Course Content		Instructional Hours / Week : 4		
Unit	Description	Text Book	Chapters	
I	Structures: Methane, Ethylene, Acetylene and Benzene. Effects: Inductive effects, mesomeric effect, Hyperconjugative effect, electromeric effect, stric effects in simple and macromolecules	1,3,5	3,1	
			<b>Instructional Hours</b>	
			<b>9</b>	
<b>Suggested Learning Methods – Experiential learning</b>			<b>2 Hrs</b>	
II	Chemical Kinetics: Rate and its law, order and its types, Molecularity and its types. Determination of order by graphical methods. Determination of Q10, Pseudo first order reactions, Activation energy-chemical reactions in absence and presence of biocatalyst Adsorption coefficient. Fractional distillation.	4,2,1	20,30, 10,5	
			<b>Instructional Hours</b>	
			<b>9</b>	
<b>Suggested Learning Methods – Problem based learning</b>			<b>2 Hrs</b>	
III	Electrochemistry: Potential difference, ions, anode and cathode. Nernst equation. Relation between Nernst and free energy	4		

	changes. Determination of free energy changes. pH and its scale. Determination of pH and pOH. Handersson equation and its importance. Buffer and its importance.		26, 27										
<b>Instructional Hours</b>			<b>9</b>										
<b>Suggested Learning Methods – Experiential learning</b>			<b>2 Hrs</b>										
<b>IV</b>	Types of electrodes – Standard Hydrogen Electrode, Calomel Electrode and Quinone Electrode, pH electrode. Limitation of each electrode.	4,2	28,9										
<b>Instructional Hours</b>			<b>9</b>										
<b>Suggested Learning Methods – Problem and experiential learning</b>			<b>2 Hrs</b>										
<b>V</b>	Green Chemistry: Synthesis of silver and gold nanoparticles by simple and macrobiomolecules. pH and temperature optima. Functionalisation of nanoparticles with biomolecules.	4	7, 26										
<b>Instructional Hours</b>			<b>9</b>										
<b>Suggested Learning Methods : Kinesthetic learning</b>			<b>02 Hrs</b>										
<b>Total Hours</b>			<b>55 Hrs</b>										
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Veeriyam V, Allied Chemistry I &amp; II, 1st Edition, 2004</li> <li>2. Atkin's Physical Chemistry, 7 th Edition, Oxford University Press, 2007.</li> <li>3. Robert Thornton Morrison and Robert Nelson Boyd, Organic chemistry, 6 th Edition, Prentice Hall of India Pvt. Ltd., 2008.</li> <li>4. B.R. Puri, L.R. Sharma &amp; Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 6 th Edition, 2005.</li> </ol>												
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Jerry March, Advanced Organic Chemistry, 4 th Edition, 2004.</li> <li>2. Paula Yurkanis Bruice, Organic Chemistry, 3 rd Edition, Pearson Education, 2018.</li> </ol>												
<b>Web. URLs</b>	<ol style="list-style-type: none"> <li>1. <a href="https://byjus.com/jee/chemical-kinetics/">https://byjus.com/jee/chemical-kinetics/</a></li> </ol>												
<b>Tools for Assessment (50 Marks)</b>													
<b>CIA I</b>	<b>CIA II</b>	<b>CIA III</b>	<b>Assignment</b>	<b>Seminar</b>	<b>Quiz</b>	<b>Total</b>							
<b>8</b>	<b>8</b>	<b>10</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>50</b>							
<b>Mapping</b>													
<b>CO \ PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO 3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO 7</b>	<b>PO8</b>	<b>PSO 1</b>	<b>PSO2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	H	H	M	M	L	H	H	H	M	M	H	H	M
<b>CO2</b>	H	H	M	M	L	L	M	M	H	H	H	H	M
<b>CO3</b>	M	H	H	H	M	M	H	H	H	L	M	H	H
<b>CO4</b>	H	M	H	M	L	H	H	M	M	L	H	M	H
<b>CO5</b>	H	H	M	M	M	L	L	H	H	M	H	H	M
H-High; M-Medium; L-Low													
<b>Course designed by</b>							<b>Verified by</b>						
Dr. V. SHANMUGAM, BIOTECHNOLOGY							Dr. N. SARANYA						



Course Code		Title		
22U3BTC203		Core Paper – III Fundamentals of Microbiology		
Semester: II		Credits: 4	CIA: 50 Marks	ESE: 50 Marks
Course Objective		To understand the basic concept and applications of microbiological techniques		
Course Category		Employability		
Development Needs		Global		
Course Description		Develop the skills of culturing microorganisms		
Course Outcomes		Teaching Methods	Assessment Methods	
CO 1	Acquire and retain basic knowledge about the development of microbiology and different microbial groups recognized by microbial systematic	Lecture	Seminar	
CO 2	Understand in the principles of optics that apply to light microscopes, Bacterial unique structures, reproduction and growth	Tutorial	Assignment	
CO 3	Understand the concept of Bacterial classification and general characteristic features	Video Lessons	Group discussion	
CO 4	Investigate bacterial population from various sample	Lectures	Quiz	
CO 5	Understand the chemistry of Microbes	Class Projects	Case study	
Offered by	Biotechnology			
Course Content		Instructional Hours / Week : 4		
Unit	Description	Text Book	Chapters	
I	<b>Definition and History Microbiology</b> : Theory of Spontaneous Generation, Germ Theory of Disease and Koch Postulates, Vaccination, Discovery of Antibiotics, Scope of Microbiology	1	1,2	
			<b>Instructional Hours</b>	<b>10</b>
<b>Suggested Learning Methods : lectures about the basics of Microbiology</b>				<b>02 Hrs</b>
II	<b>Basic Principles in Microscopy:</b> Invention of Microscope - Light Microscopy, Magnification and Resolution, Dark Microscopy, and Phase contrast Microscopy. <b>Bacterial Structure and Growth:</b> Bacilli, Cocci & Spirals, Flagella, Pili, Gycocalyx, Cell Wall, Cell Membrane & Endospore, Bacterial Reproduction – Binary Fission, Bacterial Growth Curve and Factors Governing Growth	1,2	3,4,5,9	
			<b>Instructional Hours</b>	<b>10</b>
<b>Suggested Learning Methods : Demonstration of Microbiological culture techniques</b>				<b>02 Hrs</b>
III	<b>Bacterial Classification:</b> Species Concept, Criteria used for Bacterial Classification, Nomenclature. Outline Classification and General Characterization of Eubacteria and Archaeobacterium Pathogenic (Bacillus, Campylobacter, Clostridium, Listeria, Mycobacterium, Salmonella & Shigella) and non-pathogenic bacteria (Lactobacillus, Staphylococcus epidermidis, E. coli, Brevibacterium, & Corynebacteriu).	1	6,7,8	
			<b>Instructional Hours</b>	<b>10</b>
<b>Suggested Learning Methods : Develop identification skills of bacteria from video lectures</b>				<b>02 Hrs</b>
IV	<b>Microbiological Media:</b> Types, Preparation, Methods of Sterilization, <b>Enumeration of Microorganisms:</b> Enumeration of Microorganisms in soil, Water and Air; Isolation of Microorganisms from Environment and Infected Tissue <b>Culture techniques:</b> Techniques of Pure Culture, Maintenance and Preservation; Staining: Stains and Types of Staining	2	8	
			<b>Instructional Hours</b>	<b>10</b>

Suggested Learning Methods : Preparation of bacterial culture methods laboratory instruments and equipments			02 Hrs										
V	Physiology and Biochemistry of Microbes: Photo-Autotrophs, Chemo-autotrophs, Parasitism, Saprophytism, Mutualism and Symbiosis, Commensalisms, Endozoic Microbes	2, 3	13,17										
<b>Instructional Hours</b>			10										
Suggested Learning Methods : Case study			02 Hrs										
<b>Total Hours</b>			60 Hrs										
<b>Text Books</b>	1. Naveen Kango, Text Book of Microbiology, I. K. International Pvt. Ltd. Publication, 2010. 2. Jeffrey C. Pommerville, Alcamo's Fundamentals of Microbiology, Jones & Bartlett Publication, 9th Edition, 2011. 3. Ananthanarayan and Paniker, Textbook of Microbiology, Orient Blackswan, 2005. 4. Joanne Willey and Linda Sherwood and Christopher J. Woolverton, Prescott's Microbiology, Tata McGraw Hill Publishers, 2014.												
<b>Reference Books</b>	1. Kathleen Park Talaro, Foundation in Microbiology, McGraw-Hill Publications, 9th Edition, 2015. 2. Gerard J. Tortora, Berdell R. Funke, Christine L. Case, Microbiology: An Introduction, Pearson Publication, 20th Edition, 2015.												
<b>Web. URLs</b>	1. <a href="https://www.edx.org/learn/microbiology">https://www.edx.org/learn/microbiology</a>												
Tools for Assessment (50 Marks)													
CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total							
8	8	10	8	8	8	50							
Mapping													
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	H	M	L	L	L	M	H	M	L	L	M
CO2	L	L	M	L	L	L	L	L	H	H	H	M	M
CO3	M	L	M	L	L	M	L	L	M	H	H	L	M
CO4	L	M	M	H	L	M	L	L	M	H	M	L	M
CO5	L	M	M	M	L	M	L	M	H	H	H	M	M
H-High; M-Medium; L-Low													
Course designed by							Verified by						
Dr. P. THIRUNAVUKKARASU, BIOTECHNOLOGY							Dr. N. SARANYA						

Course Code		Title		
22UGBTA202		Allied Paper – II Chemistry – II		
Semester: II		Credits: 4	CIA : 30 Marks	ESE: 45 Marks
Course Objective		To realize the importance of basics in assemblage of small molecules.		
Course Category		Employability		
Development Needs		Regional		
Course Description		It elaborates basic structure of organic molecule, prediction of chemical properties and feasibility of reactions.		
Course Outcomes		Teaching Methods	Assessment Methods	
CO 1	To know the outcome of amino acid modifications	Experiential learning	Seminar	
CO 2	To Understand the importance of enzyme kinetics	Experiential learning	Problem solving	
CO 3	retrieve meaningful conclusion from thermodynamic parameters	Experiential learning	Problem solving	
CO 4	know the limitations of each concept and looking for an alternatives in analysis	Activity based learning	Assignment	
CO 5	Know the importance of electrochemistry in lysis	Lecture method	Assignment	
Offered by	Biotechnology			
Course Content			Instructional Hours / Week : 4	
Unit	Description	Text Book	Chapters	
I	Amino acid modifiers and coupling agent: Coupling reagents and biomolecule modifiers – carboxylic groups, protein attached with ethylene glycol, thiol modifications, Tyrosine, tryptophan and intramolecular cross linking	1, 2	10, 6	
Instructional Hours			9	
Suggested Learning Methods – Experiential learning			2 Hrs	
II	Radioactivity: Radioactive elements: alpha, Beta & Gamma emitters in analysis. Half Life period. Quantification of Biomolecules in diagnosis and its advantageous and disadvantageous with other reagents. Limitations of reagents in analysis	5,4	10, 6	
Instructional Hours			9	
Suggested Learning Methods – Problem based learning			2 Hrs	
III	Enzyme Kinetics: Enzyme activity, Units, MM equation and its importance. Determination of Vmax & Km by various plots. Its importances. Determination of thermodynamic and kinetic parameters	3	15	
Instructional Hours			9	
Suggested Learning Methods – Experiential learning			2 Hrs	
IV	Electrochemistry: Kohlrauschs law. Resistance and Conductance, Specific, equivalent and molar conductance. Conductometric titrations- weak acid, strong acids and mixture of acids.	4	6	
Instructional Hours			9	
Suggested Learning Methods – Problem and experiential learning			2 Hrs	
V	Application of Analytical Techniques: Absorption spectroscopy- UV/VIS, IR, Resonance Raman, Fluorescence and NMR Spectroscopic techniques in analysis and its limitations/applications.	4	26	
Instructional Hours			9	



Suggested Learning Methods : Kinaesthetic learning													02 Hrs		
													Total Hours		55 Hrs
<b>Text Books</b>			1. Creighton T. E., Protein Function - A Practical Approach, 2 nd Edition, Oxford University Press 2004. 2. Trevor Palmer, Enzymes- Biochemistry, Biotechnology & Clinical 3. Biochemistry, East-West Press Pvt. Ltd. New Delhi, 2004. 4. Irwin H. Segel, Biochemical Calculation, John Wiley & Sons, Pvt. Ltd,6th Edition, 2010. 5. Puri B.R., Sharma L.R. & Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 6 th Edition, 2005.												
<b>Reference Books</b>			1. Atkin's Physical Chemistry, 7 th Edition, Oxford University Press, 2007. 2. David Freifelder, Physical Biochemistry, W.H. Freeman & Company, 2nd Edition, 2008. 3. Creighton T. E., Protein Structure - A Practical Approach. 2nd Edition, Oxford University Press, 2004.												
<b>Web. URLs</b>			1. <a href="https://byjus.com/jee/chemical-kinetics/">https://byjus.com/jee/chemical-kinetics/</a> 2. <a href="https://www.youtube.com/watch?v=UOGMqrkJYIM">https://www.youtube.com/watch?v=UOGMqrkJYIM</a>												
Tools for Assessment (50 Marks)															
CIA I		CIA II			CIA III			Assignment		Seminar		Quiz		Total	
8		8			10			8		8		8		50	
Mapping															
CO \ PO	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	H	H	M	M	L	H	H	H	M	M	H	H	M		
CO2	H	H	M	M	L	L	M	M	H	H	H	H	M		
CO3	M	H	H	H	M	M	H	H	H	L	M	H	H		
CO4	H	M	H	M	L	H	H	M	M	L	H	M	H		
CO5	H	H	M	M	M	L	L	H	H	M	H	H	M		
H-High; M-Medium; L-Low															
Course designed by								Verified by							
DR. V. SHANMUGAM, BIOTECHNOLOGY								DR. N. SARANYA							

Course Code		Title		
22U3BTP204		Core Paper – IV Biotechniques and Microbiology Practical		
Semester: II		Credits: 4	CIA: 50 Marks	ESE: 50 Marks
Course Objective		Provide students with an understanding of important facts, concepts, and the investigative procedures of a biophysical and microbiology laboratory.		
Course Category		Employability		
Development Needs		Skill development		
Course Description		Develop the skills of basic instruments usage and microbiological techniques		
Course Outcomes		Teaching Methods	Assessment Methods	
CO 1	Acquire and retain basic knowledge about Biotechniques and microbiology practical's and its safety measures	Project based learning	Industrial visit	
CO 2	Understand the operation techniques of basic biophysical instruments	Project based learning	Hands on Training	
CO 3	Demonstrate the methods for isolation, subculture and maintenance of bacterial specimens	Project based learning	Hands on Training	
CO 4	Examine aseptic technique	Project based learning	Hands on Training	
CO 5	Investigate bacterial morphology and physiology	Project based learning	Hands on Training	
Offered by	Biotechnology			
Course Content		Instructional Hours / Week : 3(I Sem), 5 (II Sem)		
Total Hours				120 Hrs
Experiments	Description			
1.	Principle and Operation of Calorimeter			
2.	Principle and Operation of Centrifuge			
3.	Principle and Operation of pH meter – Measurement of pH.			
4.	Preparation of Phosphate Buffer			
5.	pKa Value Determination			
6.	Beer Lamberts Law Verification			
Microbiology				
7.	Laboratory Safety Guidelines - Bio Safety Cabinets			
8.	Microscopy – Bright Field			
9.	Cleaning and Sterilization of Glassware's			
10.	Sterilization - Moisture, Dry Heat and Filter Sterilization.			
11	Preparation of Culture Media – Liquid and Solid			
12.	Aseptic Technique and Culture Inoculation			
13.	Serial Dilution Technique			
14	Measurement of bacterial growth.			
.15	Morphological Variations of Bacteria– Measurement of bacterial size.			
.16.	Smear Preparation and fixation			
17.	Simple Staining			
18.	Gram Staining			
19.	Motility test			
20.	Cultivation of Anaerobic Bacteria			
			Instruction hours	120

													Total Hours	120
Text Books													Ashish S. Verma, Surajit Das and Anchal Singh. Laboratory Manual for Biotechnology, 2014,	
Reference Books													Dimitris Dogramatzis, Healthcare Biotechnology A Practical Guide. 2016. CRC Publications.	
Web. URLs													1. <a href="https://www.google.co.in/books/edition/Experimental_Biotechnology/7K4ESNbL9tUC?hl=en&amp;gbpv=1&amp;dq=biotechniques+practical+manual&amp;prints_ec=frontcover">https://www.google.co.in/books/edition/Experimental_Biotechnology/7K4ESNbL9tUC?hl=en&amp;gbpv=1&amp;dq=biotechniques+practical+manual&amp;prints_ec=frontcover</a>	
<b>Tools for Assessment (50 Marks)</b>														
Analytical Skills	Lab Performance	Inference	Test I			Test II			Test III			Total		
8	8	8	10			10			6			50		
<b>Mapping</b>														
CO PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	H	H	-	-	-	-	-	L	H	H	H	H	M	
CO2	H	H	-	-	-	-	-	L	M	L	H	H	H	
CO3	H	H	-	L	-	-	-	L	H	M	H	M	H	
CO4	H	H	-	L	-	-	-	L	H	L	H	H	H	
CO5	H	H	-	-	-	-	-	L	M	M	H	M	H	

H-High; M-Medium; L-Low

Course designed by	Verified by
Dr.P.SENTHILKUMAR, BIOTECHNOLOGY	DR.N.SARANYA

Course Code		Title				
21U3BTR203		Allied Paper III - Chemistry Practical				
Semester: I& II		Credits: 2		CIA : 25 Marks		ESE: 25 Marks
Course Objective		To test the hypothesis by experiments and reach meaningful conclusions.				
Course Category		Employability				
Development Needs		Skill development				
Course Description		Methodologies followed in determining various physical parameters.				
Course Outcomes			Teaching Methods	Assessment Methods		
CO 1	Reason out and analyze pI of amino acids		Project based learning	Hands on Training		
CO 2	Know to harness the reaction at ambient conditions		Project based learning	Hands on Training		
CO 3	Finding out enzyme kinetic parameters		Project based learning	Hands on Training		
CO 4	Graphically finding out the order of reactions		Project based learning	Hands on Training		
CO 5	Understanding monolayer adsorption of ligands on solids		Project based learning	Hands on Training		
Offered by		Biotechnology				
Course Content			Instructional Hours / Week : 2 (I Sem), 4 (II Sem)			
Total Hours						90 Hrs
Experiments		Description				
1.		Determination of pI of Alanine and Glycine				
2.		Determination of activation energy of an uncatalysed and catalysed reactions				
3.		Quantifying amount of metal iron (2+) by volumetric titrations				
4.		Determining strength of weak and strong acids by conductometric titrations				
5.		Determination of $V_{max}$ and $K_m$ of peroxidase				
6.		Determination of thermodynamic parameters like $\Delta G$ , $\Delta H$ , $\Delta S$ values				
7.		Determination of order of ester hydrolysis				
8.		Determination of adsorption coefficient – Langmuir isotherm				
					<b>Total Hours</b>	<b>90</b>
Text Books		Shaik. Munwar, Comprehensive Practical Manual of Pharmaceutical Chemistry, 2019, Educreation Publishing				
Reference Books		Manoj Kumar Solanki, Engineering Chemistry Laboratory Manual, 2019, Educreation Publications				
Web. URLs		<a href="https://www.google.co.in/books/edition/Chemistry_in_the_Laboratory/5tihRj34EhcC?hl=en">https://www.google.co.in/books/edition/Chemistry_in_the_Laboratory/5tihRj34EhcC?hl=en</a>				
<b>Tools for Assessment (25 Marks)</b>						
Test I	Test II	Analytical Skills	Lab performance	Inference	Observation Note Book	Total
5	5	4	4	4	3	25
<b>Mapping</b>						

CO PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	L	L	L	M	L	M	H	L	M	M	L	L	M
CO2	L	L	M	L	L	H	L	M	H	M	L	H	M
CO3	M	L	L	L	L	L	L	M	M	M	H	H	L
CO4	L	L	L	M	L	M	H	L	H	H	M	H	M
CO5	M	L	M	L	M	L	M	H	M	H	H	M	M

H-High; M-Medium; L-Low

Course designed by	Verified by
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