

**Department of Liberal Education**  
**Era University, Lucknow**  
**Course Outline**  
**Effective From: 2023-24**

<b>Name of the Program</b>	<b>B.A. / B.Sc. (LIBERAL EDUCATION)</b>			<b>Year/ Semester:</b>	<b>3<sup>rd</sup> / 5<sup>th</sup></b>
<b>Course Name</b>	<b>Basic Biochemistry and Microbial Physiology</b>	<b>Course Code:</b>	<b>MB302</b>	<b>Type:</b>	<b>Theory</b>
<b>Credits</b>	<b>04</b>			<b>Total Sessions Hours:</b>	<b>60 Hours</b>
<b>Evaluation Spread</b>	<b>Internal Continuous Assessment:</b>	<b>50 Marks</b>		<b>End Term Exam:</b>	<b>50 Marks</b>
<b>Type of Course</b>	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
<b>Course Objectives</b>	<p>This module will help students to understand following;</p> <ol style="list-style-type: none"> <li>a. Basic of thermodynamics</li> <li>b. Structure &amp; Classification; Water, Carbohydrates &amp; Proteins</li> <li>c. Structure &amp; Classification; Lipids &amp; Nucleic acids</li> <li>d. Classification of enzymes</li> <li>e. Bacterial growth curve</li> <li>f. Stress Physiology</li> <li>g. Nitrogen metabolism</li> </ol>				
<b>Course Outcomes (CO):</b> <i>After the successful course completion, learners will develop following attributes:</i>					
<b>Course Outcome (CO)</b>	<b>Attributes</b>				
<b>CO1</b>	They will have understood the basic principles of thermodynamics applied to biological systems				
<b>CO2</b>	Student will be conversant with the structures of carbohydrates, lipids, proteins and nucleic acids.				
<b>CO3</b>	Students will understand and comprehend the basic concepts of enzyme biochemistry including enzyme kinetics, and will become aware of different variants of enzymes found in living cells.				
<b>CO4</b>	Students will be acquainted with the diverse physiological groups of bacteria/archaea and microbial transport systems and will have an in-depth knowledge of patterns of bacterial growth, bacterial growth curve, calculation of generation time and specific growth rate, and effect of the environment on growth. They will also apprehend how biochemical pathways are used by bacteria for energy generation and conservation during growth on glucose under aerobic and anaerobic conditions with the physiology of nitrogen fixation.				
<b>Pedagogy</b>	Interactive, discussion-bases, student-centered, presentation.				
<b>Internal Evaluation Mode</b>	Mid-term Examination: 20 Marks Activity: 10 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks				

Session Details	Topic	Hours	Mapped CO
Unit 1	<p><b>Overview of thermodynamics and bioenergetic</b></p> <ul style="list-style-type: none"> <li>Basics of thermodynamics- First and second laws</li> <li>Concept of enthalpy, entropy, free energy change, standard free energy change</li> <li>Equilibrium constant and spontaneous reactions and coupled reactions</li> </ul> <p><b>Activity:</b> Thermodynamics and Future equilibrium –Creative writing.</p>	15	CO1
Unit 2	<p><b>Water &amp; Carbohydrates</b></p> <ul style="list-style-type: none"> <li>Structure and properties of water, HandersonHasselbalch equation, Ionic product of water, pH and buffers.</li> <li>Structure &amp; classification of carbohydrates</li> <li>Carbohydrates metabolism: glycolysis, fermentation, Pentose phosphate pathway (PPP), EntnerDoudoroff pathway, Krebs Cycle, Electron transport chain (ETC)</li> </ul> <p><b>Proteins Structure &amp; Classification-</b></p> <ul style="list-style-type: none"> <li>Protein structure: primary, secondary- peptide unit salient features, <math>\alpha</math> helix, <math>\beta</math> sheet, <math>\beta</math> turn, tertiary and quaternary.</li> </ul> <p><b>Lipids &amp; Nucleic acids</b></p> <ul style="list-style-type: none"> <li>Structure and classification of lipids.</li> <li>Metabolism of lipids- Alpha and beta oxidation of lipid</li> <li>Nucleic acids Structures</li> <li>Physico-chemical properties of DNA</li> <li>RNA types, rRNA, mRNA, Trna</li> </ul> <p><b>Activity:</b> Simple qualitative test for carbohydrates and proteins</p>	15	CO2
Unit 3	<p><b>Enzymology concepts</b></p> <ul style="list-style-type: none"> <li>Concepts of holozymes, apoenzyme, cofactors, prosthetic group, coenzyme, metal cofactors</li> <li>Classification of enzymes</li> <li>Active site and activation energy</li> <li>Lock and key hypothesis, induced fit hypothesis; enzyme kinetics</li> <li>Allosteric enzymes-cooperativity</li> <li>Enzyme inhibition: competitive and noncompetitive</li> </ul> <p><b>Activity:</b> Make a list of use of enzymes in pharmaceuticals (diagnostic/treatment) purpose –make power point presentation</p>	15	CO3
Unit 4	<p><b>Microbial growth and effect of environmental factors on growth</b></p> <ul style="list-style-type: none"> <li>Bacterial growth curve and kinetics-Generation time and specific growth rate</li> <li>Diauxic growth and synchronous growth</li> <li>Batch, Fed batch and continuous cultures</li> </ul> <p><b>Stress physiology and Nitrogen metabolism</b></p> <ul style="list-style-type: none"> <li>Effect of oxygen, pH, osmotic pressure, heat shock on bacteria</li> <li>Microbial adaptation to Environment-Temperature, pH, Oxygen, Pressure, Salt, Water activity</li> <li>Extremophiles application in industry</li> <li>Dissimilatory nitrate reduction</li> </ul> <p><b>Activity:</b> Presence of microbes in different sources of drinking water and plate it on agar plate to check the growth.</p>	15	CO4

CO-PO and PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1				1	1	1	1		2		1			
CO2			2			1	1		2		1	3		
CO3	1		2			2	1		2		1			
CO4						1	1				1			
<i>Strongcontribution-3,Averagecontribution-2, Lowcontribution-1,</i>														
<b>Suggested Readings:</b>														
<b>Text- Books</b>	1. Moat A.G., Foster J.W. and Spector M.P. 2002. Microbial Physiology, 4th edition. A Johan Wiley and sons inc., publication.													
<b>Reference Books</b>	1. Moat A.G., Foster J.W. and Spector M.P. 2002. Microbial Physiology, 4th edition. A Johan Wiley and sons inc., publication 2. Kim B.H. and Gadd G.M. 2008. Bacterial physiology and metabolism Cambridge University Press, Cambridge 3. Gilbert H.F. 2000. Basic concepts in biochemistry: A student's survival guide. Second Edition. Mc-GrawHill Companies, health professions Division, New York													
<b>Para Text</b>	<b>Unit 1:</b> 1. <a href="https://www.classcentral.com/tag/microbiology">https://www.classcentral.com/tag/microbiology</a> <b>Unit 2:</b> 1. <a href="https://www.labster.com/microbiology-virtual-labs">https://www.labster.com/microbiology-virtual-labs</a> <b>Unit 3:</b> 1. <a href="https://www.cpe.rutgers.edu/courses/current/lf0401wa.html">https://www.cpe.rutgers.edu/courses/current/lf0401wa.html</a> <b>Unit4:</b> 1. <a href="https://www.sciencedirect.com/topics/earth-and-planetary-sciences/microscopy">https://www.sciencedirect.com/topics/earth-and-planetary-sciences/microscopy</a>													
<b>Recapitulation &amp; Examination Pattern</b>														
<b>Internal Continuous Assessment:</b>														
<b>Component</b>	<b>Marks</b>	<b>Pattern</b>												
<b>Mid Semester</b>	20	<b>Section A:</b> Contains <b>10</b> MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries <b>0.5 mark</b> . <b>Section B:</b> Contains <b>07</b> descriptive questions out of which <b>05</b> questions are to be attempted. Each question carries <b>03 marks</b> .												
<b>Activity</b>	10	Will be decided by subject teacher												
<b>Class Test</b>	05	Contains <b>05 descriptive questions</b> . Each question carries <b>01</b> mark.												
<b>Online Test/ Objective Test</b>	05	Contains <b>10 multiple choice questions</b> . Each question carries <b>0.5</b> mark.												
<b>Assignment/ Presentation</b>	05	Assignmet to be made on topics and instruction given by subject teacher												
<b>Attendance</b>	05	As per policy												
<b>Total Marks</b>	<b>50</b>													

Course created by: Dr. Manaal Zahera

Signature:

Approved by: Dr. Amita Jain

Signature: