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

Name of the Program	**B.A. / B.Sc. (LIBERAL EDUCATION)**			**Year/ Semester:**	**1st Year / 2nd Semester**
Course Name	Bio Molecules-Metabolism & Functions	**Course Code:**	**BCH102**	**Type:**	**Theory**
Credits	**05**			**Total Sessions Hours:**	**75 Hours**
Evaluation Spread	**Internal Continuous Assessment:**	**50 Marks**		**End Term Exam:**	**50 Marks**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	The students will learn about mechanism of functions of bio-molecules in this paper. The students will learn about the importance, types and mechanism of functioning of enzymes.The students will learn about the interplay of various metabolic pathways that work synergistically or antagonistically to maintain homeostasis. In continuation with previous semester, the student would learn about the mechanism, energy and enzymes through which molecules work together to provide energy, growth and reproduction.				

Course Outcomes(CO): *After the successful course completion, learners will develop following attributes:*

Course Outcome (CO)	**Attributes**
CO1	Students can understand role of enzymes in biological system, its classification and mechanism along with factors that regulate its functions
CO2	The students can delineate the laws and factors involved in energy transfer in biological system.
CO3	The students will learn about the synthesis and pathway of carbohydrate, proteins, lipids, nucleic acids catabolism to yield energy and other pathways
CO4	At the end of the paper student will understand a living organism works in tandem with chemical, physical and biological principals
Pedagogy	Interactive, discussion-bases, student-centered, presentation.
Internal Evaluation Mode	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	**Metabolism in organisms:** definition, types, components, important terminologies, role of enzymes, energy molecules **Introduction to enzymes**: • Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes. • Enzyme as catalysts: Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis. • Effect of pH, temperature and metal ions and other factors on the activity of enzyme. • Enzyme kinetics: Michaelis-Menten equation, Lineweaver-Burk plot, Km, Kcat and Vmax, turnover number. • Reaction rates and thermodynamics of reaction. • Enzyme inhibition: Reversible inhibition (competitive, uncompetitive, non-competitive, feedback). Mechanism based inhibitors - antibiotics as inhibitors. • Isoenzymes - properties and physiological significance (lactate dehydrogenase) **Activity**: 1. Learning the effects of pH and temperature on enzymes while making yogurt 2. Students will prepare slides on role of enzymes in household and daily activities and present it**.**	19	CO1
Unit 2	**Principle of Bioenergetics**: • Bioenergetics and thermodynamics, • Laws of Thermodynamics; Gibbs free energy, enthalpy; entropy and their relationships • Free energy change **Carbohydrate metabolism-** • Concept of Aerobic and Anaerobic respiration, Fermentation • Steps and energetics of fermentation • Introduction to Stage 1: Glycolysis for glucose, ▪ Stage 2: Citric Acid Cycle (or Kreb cycle) ▪ Stage 3: Electron Transport Chain and ATP synthesis. • Oxidative phosphorylation and control of ATP production • Molecules, enzymes and energetic of pathways of Glycolysis, Citric Acid Cycle and Electron Transport Chain • Glycogenesis and Glycgenolysis; Control of glycogen	19	CO2, CO3

	metabolism, Glycogen storage and its diseases • Significance of Gluconeogenesis, Pentose phosphate pathway **Activity:** 1. Showing mnemonics to learn and remember various molecules in the carbohydrate metabolism cycles 2. Making of posters, models pertaining to carbohydrate metabolism and its exhibition and competition		
Unit 3	**Protein Metabolism:** • Deamination and transamination reactions, transport of ammonia, Urea Cycle • Inborn errors of protein metabolism: Alkaptonuria, Phenylketonuria • Glucogenic and ketogenic amino acids • Overview of amino acid synthesis • Diseases associated with abnormal protein metabolism **Lipid Metabolism:** • Degradation of fatty acids, • β oxidation, regulation of fatty acid oxidation, • Ketone-body metabolism, Cholesterol synthesis, Fatty acid synthase complex enzyme • Concept of synthesis of saturated, unsaturated, odd and even chain fatty acids • Regulation of fatty acid metabolism • Diseases associated with abnormal lipid metabolism **Activity**: 1. Tests for presence of proteins 2. Tests for presence of free fatty acids	19	CO3
Unit 4	**Nucleic Acid Metabolism**: • De novo and salvage pathway synthesis of purine and pyrimidine nucleotides • Degradation of purine and pyrimidine nucleotides • Inhibitors of nucleotide metabolism • Disorders of purine and pyrimidine metabolism **Concept of ROS production and antioxidant mechanisms** **Activity:** 1. Playing quiz pertaining to nucleic acid metabolism 2. Visit to hospital diagnostic biochemistry laboratory and learning about tests done through semi/ auto analyzer	18	CO3, CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	3	2	2	3	2	1	3	3	3	2	2	2
CO2	2	2	2	3	2	3	2	2	3	2	3	2	2	2
CO3	3	3	3	2	3	2	3	2	3	3	3	2	2	3
CO4	3	3	2	2	2	3	3	3	3	3	3	3	2	3

Strongcontribution-3, ***Averagecontribution-2,Lowcontribution-1,***

Suggested Readings:

Text-Books	1. Lehninger Principles of Biochemistry, Nelson & Cox. Macmillan Learning Publisher. 7th Edition/ Latest edition. **2.** Biochemistry, Satynarayana & Chakrapani. Reed Elsevier India Private Limited and Books and Allied (P) Ltd. 4th/ Latest Edition 3. Concepts in Biochemistry, Rodney F Boyer. Brooks/Cole Publishing Company Latest Edition
Reference Books	1. Lippincott Illustrated Reviews Biochemistry, DR Ferrier, Latest Edition 2. Textbook of Biochemistry, Prasad R M. Prasad Book House.6th/Latest Edition 3. Textbook of Medical Biochemistry, Dinesh Puri. Elsevier Science.3rd/Latest Edition
Para Text	**Unit I Enzymes:** **https://youtu.be/Ejrvda9QRtI** **http://192.168.7.13:808/medlab/playclasslecture?lectid=995&deptid=12** **Enzyme metabolism** http://192.168.7.13:808/medlab/playclasslecture?lectid=998&deptid=12 **Enzyme kinetics** https://youtu.be/Cck3US2EBmU https://youtu.be/nivkBZkmu14 **Unit II** http://192.168.7.13:808/medlab/playclasslecture?lectid=390&deptid=12 http://192.168.7.13:808/medlab/playclasslecture?lectid=817&deptid=12 **Unit III** **Metabolism of branched chain amino acids** **http://192.168.7.13:808/medlab/playclasslecture?lectid=398&deptid=12** **Fatty acid synthesis:** **http://192.168.7.13:808/medlab/playclasslecture?lectid=1177&deptid=12**

	Unit IV **Purine and pyrimidine catabolism:https://youtu.be/oBMKSFGj_2E** **Mnemonics (De Novo Pyrimidine Synthesis): https://youtu.be/M5qV9Lje5SE** **Mnemonics for de novo Purine synthesis: https://youtu.be/MGmOSYiguag** **Purine metabolism:** http://192.168.7.13:808/medlab/playclasslecture?lectid=962&deptid=12 https://youtu.be/e2KFVvI8Akk **Pyrimidine metabolism:** http://192.168.7.13:808/medlab/playclasslecture?lectid=881&deptid=12 https://youtu.be/4cw9TMzvO8Y

Recapitulation & Examination Pattern

Component	Marks	Pattern
Mid Semester	20	**Section A:** Contains **10** MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries **0.5Marks.** **Section B:** Contains **07** descriptive questions out of which **05** questions are to be attempted. Each question carries **03 Marks**.
Activity	10	Will be decided by subject teacher
Class Test	05	Contains **05 descriptive questions.** Each question carries **01** Mark.
Online Test/ Objective Test	05	Contains **10 multiple choice questions.** Each question carries **0.5**Marks.
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher
Attendance	05	As per policy.
Total Marks	**50**	

Course created by: Dr. Ghazala Zaidi **Signature:**	**Approved by: Prof. Sudhir Mehrotra** **Signature:**