Programme	Biochemistry	Course Code	BC. 304	Credit Hours	3
Course Title	**Bioenergetics**				

Course Introduction

This course introduces the fundamental principles of bioenergetics, focusing on how energy is produced and utilized in biological systems. Students will explore thermodynamics, energy changes in biochemical reactions, and the mechanisms of ATP synthesis through processes like oxidative phosphorylation and the electron transport chain. The course also covers the regulation of energy production, the role of high-energy compounds, and the impact of inhibitors on energy pathways, providing a broad understanding of how cells generate and manage energy.

Learning Outcomes

On the completion of the course, the students will:

- Understand the bioenergetic principles
- Demonstrate the detailed understanding of electron transport chain
- Acquire in-depth understanding of the mechanism of ATP synthesis and its regulation

Course Content

- Introduction to bioenergetics
- Energy transduction in biological System
- Basic principles and laws of thermodynamics
- Free energy, enthalpy, entropy and their relationships
- Free energy change and standard free energy change in biochemical Reactions
- Endothermic, exothermic, endergonic and exergonic reactions
- Biological Redox reactions in mitochondria and redox enzymes
- Synthesis and importance of high energy compounds
- Coupling of reactions
- Substrate level phosphorylation, oxidative phosphorylation and photophosphorylation
- Redox potential and sequence of the carriers of electron transport chain
- Complexes of ETC, their composition and flow of electrons through the complexes
- Shuttle systems for transport of cytoplasmic NADH in different organs
- Proton pumping, proton motive force and mechanism of ATP Synthesis
- Chemiosmotic theory and Binding change model for ATP synthesis
- Auto-regulation of ATP synthesis according to cell energy charge, Un couplers and inhibitors of electron transport chain

Textbooks and Reading Material

- B. Harrow and A. Mazur W.B *Text Book of Biochemistry (1971)*. Saunders Company.
- By R.K. Murray, D.K. Grannar,V.W. Rodwell. *Harper's Illustrated Biochemistry, 27th Ed.* McGraw Hill.
- P.W. Atkin (2002). *Physical Chemistry* 7th Edition by Oxford University Press
- R.J. Sibley, R.A. Alberty & M.G (2004). *Physical Chemistry* 4th Edition. BawendiJ. Wiley& Sons

Teaching Learning Strategies

- Lectures
- Assignments and Presentations
- Group discussions

- Interactive sessions

Assignments: Types and Number with Calendar

- Quiz in 4th week of 5 marks
- Assignments in 8th week of 10 marks
- Presentations in 12th week of 10 marks

Assessment

Sr. No.	Elements	Weightage	Details
1	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.