GENERIC ELECTIVE – 3:

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Chemistry of Amino acids, Proteins and Enzymes; ALS CHEM GE - 3	**4**	**2**	**0**	**2**	Class XII pass with Biology and Chemistry	NA

Learning Objectives:

The Learning Objectives of this course are as follows:

- To deliver information about biochemically significant features of the chemistry of peptides, proteins, enzymes by using suitable examples.
- To provide knowledge about classification, reaction chemistry and biological importance of these biomolecules.
- To extend the knowledge gained from synthetic organic chemistry to chemistry of biomolecules.
- To make students understand the structural principles that govern reactivity/physical /biological properties of biomolecules as opposed to learning structural detail.
- To build the concept of metabolism by the study of chemistry and energetics of biological system.

Learning Outcomes:

By studying this course, students will be able to:

- Familiarize with the structure of biomolecules (proteins, enzymes), their chemical properties, reactivity and biological uses.
- Gain an insight into mechanism of enzyme action and inhibition.

- Understand the basic principles of drug-receptor interaction and SAR.
- Understand the concept of metabolism and metabolic processes through specific examples.

Unit -1: Amino acids, Peptides & Proteins (12 Hours)

Amino Acids and Peptides -Zwitterion, isoelectric point and electrophoresis. Preparation of amino acids: Strecker synthesis and using Gabriel's phthalimide synthesis. Reactions of amino acids: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test.

Determination of the primary structure of peptides by degradation Edman degradation (N-terminal) and C– terminal (thiohydantoin and with carboxypeptidase enzyme).

Synthesis of simple peptides (up to dipeptides) by N-protection (*t*-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis. An Overview of primary, secondary, tertiary and quaternary structure of proteins.

Unit-2: Enzymes (8 Hours)

Classification of enzymes and their uses (mention ribozymes). Mechanism of enzyme action, factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereo-specificity), enzyme inhibitors and their importance, and the phenomenon of inhibition (competitive and non-competitive inhibition including allosteric inhibition). Drug action-receptor theory. Structure – activity relationships of drug molecules, binding role of –OH group, $-NH_2$ group, double bond and aromatic ring.

Unit- 3: Concept of Energy in Biosystems (10 Hours)

Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism). ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD+, FAD. Conversion of food to energy: Outline of catabolic pathways of carbohydrate-glycolysis, fermentation, Krebs cycle. The caloric value of food, the standard caloric content of food types.

PRACTICAL (60 hours)

1. Qualitative tests for amino acids and proteins.
2. Separation and identification of mixture of amino acids by paper chromatography.
3. Study the action of salivary amylase on starch under optimum conditions and determine the enzyme activity.
4. Study the effect of temperature and pH on the activity of salivary amylase.
5. Isolation of casein from milk.
6. Estimation of protein by Lowry's method.
7. To study the effect of concentration, temperature and pH on the activity of catalase.
8. Estimation of glycine by Sorensen's method.
9. To study the titration curve of glycine and determine the isoelectric point of glycine.

Essential/recommended readings

1. Lubert Stryer, Jeremy Berg, John Tymoczko, & Gregory Gatto. (2019). *Biochemistry* (9thed.). W.H. Freeman.
2. Lehninger, A. L., & Nelson, D. L. (2009). *Principles of biochemistry*. W. H. Freeman.
3. Finar, I. L. (2007). *Organic chemistry* (Vol 1 & 2). Pearson education.
4. Mehta, B., & Mehta, M. (2015). *Organic Chemistry* (2nd ed.). PHI Learning Pvt. Ltd.
5. T. W. Graham Solomons, Craig B. Fryhle, & Scott A. Snyder. (2013). *Solomons's Organic Chemistry*(7th ed.). Pearson Education India.
6. Ghatak, K. L. (2014). *A textbook of organic chemistry and problem analysis*. PHI Learning.

Suggestive readings

1. Dean, J. R., Jones A.M, Holmes, D., & Reed, R. (2011). *Practical Skills in chemistry*. Prentice-Hall.
2. Wilson, K., & Walker, J. M. (2000). *Principles and techniques of practical biochemistry*. Cambridge University Press.
3. Varley, Harold., Gowenlock, A. H., McMurray, J. R., McLauchlan, D. M., & Varley, Harold. (1988). *Varley's practical clinical biochemistry*. CRC Press.

4. Mann, F. G., & Saunders, B. C. (2009). *Practical organic chemistry*. Pearson Education.
5. Pasricha, S., & Chaudhary, A. (2021). *Practical Organic Chemistry* (Volume II). IK International Publishing House Pvt. Ltd.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.