

11.2. DISCIPLINE SPECIFIC ELECTIVES (DSE)

11.2.1. Course Code: ANALYTICAL CHEMISTRY (DSE-AC1)

Course Title: ANALYTICAL BIOCHEMISTRY

Total Credits: 04 (Credits: Theory-02, Practical-02)

(Total Lectures: Theory- 30, Practical-60)

Objectives: The Objective of the courses to learn about proteins, enzymes, nucleic acids and lipids, using suitable examples, drug receptor interaction and Structure Activity Relation (SAR) studies along genetic code and concept of heredity.

Learning Outcomes:

By the end of this course, students will be able to:

- Learn about structures of carbohydrates and Proteins
- Learn about the molecules, macromolecules, polymers and their formations
- Learn about the metabolism of a few biomolecules.
- Know basic principles of drug-receptor interaction and structure activity relationship (SAR).
- Know biochemistry of diseases.

Unit 1: Carbohydrates and Proteins:

Basic understanding of the structures and properties of carbohydrates, biological importance of Carbohydrates.

Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, Haworth projections and conformational structures; Structure elucidation of glucose and fructose (Fischer's proof), Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation;

Disaccharides – Structure elucidation of maltose, lactose and sucrose.

Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

Amino Acids, Peptides and Proteins:

α -Amino Acids - Classification and characterization, Zwitterions, pKa values, isoelectric point and electrophoresis;

Proteins: Classification, Primary, secondary and tertiary structures of proteins, test for proteins, isolation, characterization, biological importance; denaturation of proteins.

Enzymes: Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes. Mechanism of enzyme action (taking trypsin as an example), factors affecting enzyme action, coenzymes and cofactors (ATP, NAD, FAD), specificity of enzyme action (including stereospecificity).

(Lectures: 16)

Unit 2: Lipids

Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Classification. Biological importance of triglycerides and phosphoglycerides and

cholesterol; Liposomes and their biological functions and underlying applications. Lipoproteins. Properties, functions and biochemical functions of steroid hormones and peptide hormones.

(Lectures:06)

Unit 3: Biochemistry of disease:

A diagnostic approach by blood/ urine analysis. **Blood:** Composition and functions of blood, blood coagulation. Blood collection and preservation of samples. Anemia.

Urine: Collection and preservation of samples. Formation of urine. Composition and estimation of constituents of normal and pathological urine. Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin.

(Lectures: 08)

PRACTICALS (Credits: 02, Laboratory Periods: 60)

1. Carbohydrate- qualitative and quantitative both.
2. Proteins-qualitative tests
4. Determination of the iodine number of oil.
5. Determination of the saponification value of an oil.
6. Determination of acid value of fats and oils.
7. Determination of cholesterol using Liebermann- Burchard reaction.
8. Estimation of DNA by diphenylamine reaction
9. Isolation and characterization of DNA from Onion/cauliflower.
10. Determination of amount of protein using Lowry's method/ Biuret method.
11. To study the activity of α -amylase.
12. To study the effect of temperature and pH on the activity of α -amylase.

REFERENCES:

- Devlin, T. M. (2010), Textbook of Biochemistry with Clinical Correlations, John Wiley & Sons.
- Berg, J.M., Tymoczko, J.L.; Stryer, L. (2010), Loose-leaf Version for Biochemistry, W.H.Freeman.
- Lehninger, A.L., Nelson, D.L.;Cox, M. (2004), Principle of Biochemistry, W.H.Freeman.
- Morrison, R. N.; Boyd, R. N. (2016) Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. (2015) Organic Chemistry (Volume 1& 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Additional References:

- Swahney, S.K.; Singh, R. (2001), Introductory Practical Biochemistry, Narosa Publishing House.
- Cooper, T.G. (2011),The Tools of Biochemistry, Wiley India Pvt Ltd.
- Wilson, K.; Walker, J. (2000), Principles and Techniques of Practical Biochemistry, Cambridge University Press.

Teaching Learning Process:

- Conventional chalk and board teaching,
- Class interactions and discussions
- Power point presentation on important topics.
- Use of ICT tools to show the structure of carbohydrates and proteins.

Assessment Methods:

- Class Tests at Periodic Intervals.
- Written assignment (s) / Presentation by individual students
- End semester University Theory and Practical Examination

Keywords: Biological importance of carbohydrates, Proteins, isolation, Lipids.

11.2.2. Course Code: ANALYTICAL CHEMISTRY (DSE-AC2)

Course Title: Green Chemistry

Total Credits: 04 (Credits: Theory-02, Practical-02)

(Total Lectures: Theory- 30, Practical-60)

Objectives: Our society is becoming more and more environmentally conscious. The concern of environmental pollution, depleting resources, climate change, ozone depletion, heaps of landfills piling up, legislation getting more restrictive with stringent environmental laws, and rising costs of waste disposal are increasing. Sustainable practices have emerged as a response to these concerns. Green chemistry represents the direction in which chemistry should be heading. It is not a new branch of chemistry but the way chemistry should be practiced. Green chemistry innovations and applications in education have not only benefited the environment but have been beneficial to businesses' economic and societal goals, too. Because it is undergraduate students who will be the community's scientists of the future, this is possible.

Learning Outcomes:

By the end of this course, students will be able to:

- Understand the 12 principles of green chemistry and will develop knowledge of toxicity, risk, and hazard of chemical substances.
- learn about atom economy and how it differs from percentage yield. Students will apply stoichiometric calculations to green chemistry applications.
- Learn to design safer chemicals, products and processes that are less toxic, than current alternatives. Hence, they will understand the meaning of inherently safer design for accident prevention and the principle "what you don't have can't harm you"
- Learn about the benefits of utilizing catalysts and biocatalysts, the use of renewable feedstocks that improve energy efficiency and protect the environment, and green solvents for leading reactions.
- Learn about the applications of Green Chemistry.