Zool-211 & 211L BIOCHEMISTRY-I Cr. 3(2+1)

Course Objectives:

1. To provide knowledge about macro molecules of eukaryotic cells and organelles, including membrane structure and dynamics;
2. To provide in-depth knowledge about the polymerized organic compounds of life.
3. To provide knowledge of the principles of bioenergetics and enzyme catalysis
4. To provide knowledge of the chemical nature of biological macromolecules, their three-dimensional structure, and the principles of molecular recognition;

Course Learning Outcome

By the end of the course, students should be able to:

1. Demonstrate knowledge and understanding of the molecules of living cells;
2. Demonstrate knowledge and understanding of the principles that govern the structures of macromolecules and their participation in molecular recognition;
3. Use basic laboratory skills and apparatus to obtain reproducible data from biochemical experiments;
4. Implement experimental protocols, and adapt them to plan and carry out simple investigations;
5. Analyse, interpret, and participate in reporting to their peers on the results of their laboratory experiments;
6. Participate in and report orally on team work investigations of problem- based assignments;

Course Contents

1. **Introduction to Macromolecules**

- Structure, types and role of various building blocks their respective macromolecules.
- Carbohydrates: Introduction; Classification Stereoisomerism, Structure, types and role of monosaccharides, oligosaccharides and
- polysaccharides; Glycosaminoglycans and glycoconjugates;
- Carbohydrates as an information carrier molecule.

2. **Amino acids, peptides & proteins:**

- Types of amino acids & their classification;
- Uncommon amino acids; Acid/base behavior of amino acids.
- Titration curves in amino acids and their importance:
- Peptides & proteins;
- Biologically active peptides & polypeptides;
- Amino acid sequence in proteins & their importance; Conjugated proteins;

3. **Purification Techniques for Proteins**

- An outline of purification techniques for proteins; column chromatography, gel electrophoresis; Isoelectric focusing;

4. **Organization of proteins:**

- Structural levels of proteins; Covalent structure of proteins;
- function of some structural & functional proteins; Hemoglobin, Cytochrome-c: Chymotrypsin, alpha Keratin and Collagen;
- Proproteins, their examples and role;

5. **Enzymes**

- Enzymes, their importance, classification & nomenclature, Function & inhibition.

6. **Lipids**:

- Introduction & classification of lipids; Fatty acids, their types; Storage lipids;

7. Classification and important characteristics;

- Triacyclglycerols; waxes Structural/membrane lipids; Glycerophospholipids with Ether andEster linkages Galactolipids & Sulfolipds: Sphingolipids their types & importance: Sterols, their structure, types & functions. Examples of Functional diversity of Lipids as Signaling molecules, Cofactors, Electron carrier, antioxidants, pigments etc.

8. Nucleic acids

- Nucleic acids and their types; Structure and role of various Bases in nucleic acids,
- Nucleoside & Nucleotides;
- Structure of DNA and RNA molecules;
- Organization and Chemistry of Double helical structure of DNA with their details.

Practical:

1. Preparation of standard curve for glucose by *ortho*-Toluidine method.
2. Estimation of glucose from blood serum or any other fluid using *ortho*-Toluidine technique.
3. Tests for detection of carbohydrates in alkaline medium.
4. Tests for detection of carbohydrates in acidic medium.
5. Tests for detection of Disaccharides.
6. Tests to demonstrate relative instability of glycosidic linkage in Disacchaide (Sucrose) & polysaccharide (Stanch) .
7. Detection of Non-Reducing sugars in the presence of reducing sugars.
8. Demonstration of Acid Hydrolysis of Polysaccharide.
9. Determination of pKa values of an amino acid by preparation of titration curves.
10. Preparation of standard curve of proteins by Biuret method.
11. Estimation of any unknown concentration of protein using Biuret technique.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks
Midterm Exam: 35 marks
Final Exam: 40 marks

Books Recommended:

1. Lehninger principle of biochemistry by David L.Nelson and Michael M.Cox, 7th latest edition,ISBN-10:1-4641-2611-9,ISBN-13:978-14641-2611-6
2. Biochemistry by Jeremy M. Berg , John L. Tymoczko; Lubert Stryer ,ISBN-10:1429229365,ISBN-13:97814229229364
3. Berg, J. M.,Tymoczko,J. L., Lubert Stryer. 2010. Biochemistry. 7th Ed.
4. Lodish, H., Berk, A., Zipursky, S. L., Paul. M., Baltimore D, Darnell, J. 2012. Molecular Cell Biology.
5. David L. Nelson, and Michael M. Cox, 2000. Lehninger Principles of Biochemistry, 3rd Ed., Macmillan Worth Publishers, New York.
6. Murray, R.K., Granner, D.K., Mayer, P.A. and Rodwells, V.W., 2000. Voet. D., Voet, J.G., and Pratt, C.W., 1999. Fundamentals of Biochemistry, John Wiley and Sons, Inc., New York.
7. Zubay, G., 1995. Biochemistry, 4th Ed., Wm. C. Brown Publishers, Inc., Oxford, England.
8. Stryer, L., 1995. Biochemistry, 6th Ed., W.H. Freeman and Company, New York.
9. Nelson, D. L., Cox, M. M. 2012. Lehninger Principles of Biochemistry. McMillan Worth Publishers, New York.
10. McKee, T., McKee, J.R. 2003.Biochemistry:

11. The Molecular Basis of Life. 3rd Edition, McGraw-Hill
12. Lodish, H., Berk, A., Zipursky, S. L., Paul. M., Baltimore D,Darnell, J. 2012. Molecular Cell Biology.
13. McKee, T., McKee, J.R. 2003.Biochemistry:
14. The Molecular Basis of Life. 3rd Edition, McGraw-Hill
15. Molecular cell biology W.H Freeman by Lodish, Berk, Krieger, Scott, Bretscher, Ploegh and Matsudaira 8th edition/latest edition,ISBN:1464183392,ISBN-13:97814641183393

Text book for Practical:

1. Plummer, David T., 1990. An Introduction to Practical Biochemistry, 4th Ed. McGraw-Hill Book Company, London.
2. Wilson, K and Walker, J., 1994. Practical Biochemistry: Principles and Techniques, 4th Ed., Cambridge University Press.
3. Sawhney, S.K and Singh, R., 2008. Introductory Practical Biochemistry, Narosa Publishing House, New Delhi, India.