**BBE1102 Cell Biology**

Course description

Course Objectives

1. To describe cell structure and functions of the cell.

2. To explain microscopically the different types of cells and tissues.

3. To explain the role of cells and tissues in normal body functions, disease and research.

Content outline:

 Cells, cell organalles: structure and functions.

 Biological membranes: structure and functions.

 Genes and gene expression.

 Cell division.

 Cell injury, cell reaction to injury

 Surgical interventions: methods of obtaining cells for study

 Tissues: structure and function. Epithelia, skin, connective tissue, specialized connective tissues

(blood, bone and cartilage), muscle, teeth, nervous tissue, glandular tissue (endocrine, exocrine).

 Cells, and tissues of the immune system

 Introduction to enzyme properties and functions. Methods of delivery

Modes of Assessment

Reference materials

Requirements

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Hours per Semester | | | | Weighted  Total  Mark | Weighted  Exam  Mark | Weighted  Continuous Assessment Mark | Credit  Units |
| LH | PH | TH | CH | WTM | WEM | WCM | CU |
| 45 | 30 | 30 | 75 | 100 | 60 | 40 | 5 |

**BBE1103: Biochemistry**

Course description

The course introduces physical chemistry as it is applied in biochemistry. It equips the learner with basic knowledge on physico-chemical properties and their effects on biological processes or reactions. The course imparts the skills of calculations on concentrations of solutions and covers the properties of solutions/biochemical media, pH & buffers and ionic equilibrium. Students will then be introduced to the structures and functions of biomolecules in biochemistry with particular references to structures and

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functions of carbohydrate, protein, lipids, and nucleic acids. There will be a focus on enzymes as proteins with specific functions.

Course objective

To strengthen students’ understanding of physical biochemistry and the structures and functions of the major biomolecules.

Learning Outcomes

After completing the course, the students should be able to:

1. Apply SI units to express concentrations of solutions in biochemistry

2. Apply prior knowledge to discuss properties of solutions/biochemical media

3. Discuss pH and buffers

4. Describe the structure and function of the major biomolecules, namely carbohydrate, protein, lipids, and nucleic acids

5. Discuss enzymes (classification, properties, catalysis, mechanisms, activity, inhibition)

**Intellectual skills**

See learning outcomes above

**Practical skills**

1. Determine the pH of a solution by titration

2. Prepare buffers and demonstrate their buffering capacity

3. Determine whether a sugar is reducing or not

4. Determine the concentration of proteins e.g. in serum

5. Demonstrate how different factors (temperature, substrate concentration, pH, inhibitors) affect enzyme activity

**General and transferable skills**

1. Appreciate teamwork in the lab.

2. Show respect to assisting personnel (laboratory technicians and other support staff)

3. Work in the lab with great caution to avoid chemical hazards

Course Content

**Acids and Bases (3 hours)**

International (SI) units in the expression of concentrations of solutions. Concept of Acid/Base, Bronsted-Lowry theory of acids and bases, ionization of strong and weak electrolytes, ,

dissociation of solutions in water, dissociation/ionization of water, pH, pOH, relationship between pH and [H+], the pH scale, buffers/buffer action, types of buffers & buffer capacity, Hendeson- hasselbalch equation and application, acid-base indicators and principles and examples.

Carbohydrates (9 hours)

Carbohydrate: classification and nomenclature of sugars, monosaccharide, disaccharide and polysaccharide structures & functions and examples of each, chemical reactions of sugars (reducing properties and optical activities)

Proteins (9 hours)

Structure, chemical classification and classification of amino acids. Peptide bonds, levels of protein organization. 3-D conformational structures of proteins e.g. myoglobin and hemolobin, protein folding and denaturation. Biological functions of proteins, globular conjugated proteins, fibrous etc.

Lipids (3 hours)

Definition of lipids, classification of lipid compounds, functions of lipids. Fatty acids, nomenclature of fatty acids, structure of triacyglycerols, phospholipids, sphingolipids, plasmalogens. lipoproteins and steroids.

Nucleic acids (6 hours)

Structure of DNA and RNA, different forms of DNA molecules, level of organization of DNA molecules, Nucleosomes and histones, types of bases in DNA/RNA, example of purine and pyrimidine bases.

Porphyrins (3 hours)

Structure and functions of phophyrins, examples of porphyrin containing compounds;

cytochromes, hemoglobin

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Vitamins and coenzymes (6 hours)

Water soluble vitamins and coenzymes: Niacin, riboflavin, pyridoxine, biotin, thiamine, folate, vitamin B12. Structure, function and role in enzyme catalysis

Enzymes (6 hours)

Enzyme nomenclature; classification and general characterisics; enzyme kinetics and inhibition: competitive, non-competitive inhibitors and un-competitive; Michaelis-Menten equation and effect of substrate concentration on enzyme activity. Factors that affect enzyme reaction rates: substrate concentration, enzyme concentration, temperature, pH, allosteric effectors, cofactors, inhibitors. Regulation of enzyme activity. Mechanisms of enzyme catalysis: acid base catalysis; covalent catalysis; metal ion catalysis.

Modes of delivery

The course will be delivered through lectures, class discussions, reading assignments and laboratory practicals.

Teaching Hrs Preparation Hrs Exam Totals Lecture 45 contact hours (3 CU) 30 hours 2 hours 77 hours Practical/Seminar 15 contact hours (1 CU)\* 30 hours - 60 hours\* Total 60 contact hours (4 CU) 60 hours 2 hours 137 hours

\* 2 hours of seminar or practical = 1 contact hour

Methods of Assessment Tests 20% Practical reports 20% Final examinations 60% Total 100%

Recommended reading

1. Biochemistry, 6th Edition. Jeremy M. Berg, John L. Tymoczko JL, Lubert Stryer L (Authors). W.

H. Freeman, 2006.

2. Lehninger Principles of Biochemistry, 5th Edition. David L. Nelson and Michael M. Cox (Authors).

W. H. Freeman, 2009

3. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd

Edition. Irwin H. Segel (Author). Wiley.

4. Harper's Illustrated Biochemistry, 28th Edition. Robert Murray, Victor Rodwell, David Bender, Kathleen M. Botham, P. Anthony Weil, Peter J. Kennedy (Authors). McGraw-Hill Medical, 2009.

Requirements

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