Addis Ababa University

Addis Ababa Institute of Technology

School of Chemical and Bio Engineering

Course name: Biochemistry and Molecular Biology

Course Code: CBEg4191

Total credit hrs: 5 ECTS

Instructors name: Mr. Misikir Milkias 2019/2020G.C

Course Contents

1. Biomolecules

The Molecules and Chemical Reactions of Life

- Introduction to Biochemistry
- The Cells and chromosomes
- Thermodynamics
- Water

Amino Acids and Proteins

- Amino acids
- Protein structure; role of weak bonds

Proteins—Primary Structure

Nucleotides and Nucleic Acids

Vitamins and Cofactors

Enzyme catalysis, protein function

2. Biochemical Reactions

Enzymes

Metabolic Pathways

Carbohydrate Metabolism

- Energy I—Introduction to Metabolism
- Glycolysis (Glucose → Pyruvate)
- Glycogen o Citric Acid Cycle (Pyruvate → NADH/FADH2)
- Electron Transport Chain (NADH/FADH2 → ATP)
- Energy II—ATP

Lipid Metabolism

- Fatty Acid Metabolism (Lipids → Acetyl-CoA) ,
- Ketone Bodies—The Fate of Unused Acetyl-CoA
- Fatty Acid Biosynthesis o Cholesterol

Amino Acid Metabolism

- Deamination of Amino Acids .Elimination of Nitrogen—Urea Cycle , Deaminated Amino Acids as Metabolic Fuels , Amino Acids as Biosynthetic Precursors , Nitrogen Fixation

3. Molecular Genetics

Mendel and genes; genetic terminology; genetic mapping

DNA and RNA o DNA and RNA—Chemistry and Structure, DNA Replication and Repair—Information Storage, RNA Replication—Information Transmission

Translation and the Genetic Code

Formation of initiation complex, prokaryotes and eukaryotes

- **Transcription.**

An introduction to the complexity of the transcriptional apparatus in higher organisms.

The basics of making RNA, in bacteria; an introduction to regulation.

How RNA polymerase recognizes (and distinguishes) genes; promoters, σ (sigma) factors.

Interaction of transcription and DNA supercoiling.

Elongation and termination.

- **Gene regulation;**

DNA-protein interactions.

Proteins interact with DNA and modulate its structure and function.

Types of DNA-binding proteins; sequence recognition; DNA-bending.

- **DNA replication.**

DNA polymerases.

Issues of the replication process: getting started, priming, unwinding the template, working accurately, hanging on, finishing and untangling.

The replication apparatus or replisome.

- **Post-transcriptional processing of RNA**

Changes in RNA after synthesis and (usually) before use.

Splicing, including alternative splicing; capping; polyadenylation.

Trimming and mRNA degradation.

4. Techniques of Protein and Nucleic Acid Purification

Protein Isolation

Solubilities of Proteins

Chromatographic Separations

Electrophoresis

Ultracentrifugation

Nucleic Acid Fractionation

Assessment/Evaluation System

Project/Assignment	15%
Quiz/Test	30%
Final	40%
Laboratory	15%

Attendance Requirements : At least 75% of lectures, tutorial and 100% of laboratory

Reference books

1. Biochemistry fourth edition; Donald Voet/ Junith G.Voet 2011

2. Principles of Biochemistry, Lehninger, Cox and Nelson, 6th edition, 2008

3. Molecular Cell Biology, 6th Edition by Lodish, Berk, Kaiser, Krieger, Scott, Bretscher. Ploegh and Darnell. W. H. Freeman and Company, New York, 2008

4. Cell and Molecular Biology: Concepts and Experiments, Sixth Edition. J. Wiley and Sons, New York, 2010