**Syllabus for Biochemistry II**

**Part II---Bioenergetics and metabolism**

**Chapter 13---Bioenergetics and biochemical reaction types**

* Bioenergetics and thermodynamics
* Phosphoryl group transfers and ATP
* Biological oxidation-reduction reactions

The students are required to understand the basic laws of thermodynamics, the concept of standard free-energy change and actual free-energy change, the function of ATP and universal electron carriers, such as NAD/NADP and FAD/FAM, in metabolism and energy transfer.

**Chapter 14&15--- Glycolysis, the pentose phosphate pathway and the catabolism of glycogen**

* Glycolysis
* Feeder pathways for glycolysis
* Regulation of glycolysis
* The pentose phosphate pathway

The students are required to understand and remember the 10 reactions of glycolysis, including the enzyme and the coenzymes involved, especially the three irreversible reactions, and the regulation of glycolysis.

**Chapter 16---The citric acid cycle**

* Production of acetyl-CoA
* Reactions of the citric acid cycle
* Regulation of the citric acid cycle
* The glyoxylate cycle

The students are required to understand and remember the reactions of the citric acid cycle, including the enzyme and the coenzymes involved, especially those irreversible reactions, and the regulation of the pathway. It is also very important to understand and remember the production of acetate and the regulation of the pathway.

**Chapter 17---Fatty acid catabolism**

* Digestion, mobilization and transport of fats
* oxidation of fatty acid
* Ketone bodies

The students are required to understand and remember the reactions of oxidation of fatty acids, including the enzyme and the coenzymes involved, and the regulation of the reactions. They are also required to understand how ketone bodies are generated.

**Chapter 18---Amino acid oxidation and the production of urea**

* Metabolic fates of amino group
* Nitrogen excretion and the urea cycle
* Pathways of amino acid degradation

The students are required to understand the reactions of the urea cycle, including the enzyme and the coenzymes involved, and the regulation of the pathway. They are also required to be familiar with the different pathways of amino acid degradation.

**Chapter 19--Oxidative phosphorylation & photophosphorylation**

* Oxidative phosphorylation

A. Electron-transfer reactions in mitochondria

1. ATP synthesis
2. Regulation of oxidative phosphorylation

The students are required to understand the electron-transfer reactions in mitochondria, the mechanism of ATP synthesis, and the regulation of oxidative phosphorylation.

* Photophosphorylation

1. General features of photophosphorylation
2. Light absorption
3. Light-driven electron flow
4. ATP synthesis by photophosphorylation

The students are required to understand the light-driven electron flow in chloroplast and the mechanism of ATP synthesis by photophosphorylation. The students are also required to understand and remember the similarities and difference between oxidative phosphorylation and photophosphorylation.

**Chapter 20---Carbohydrate biosynthesis**

* Gluconeogenesis
* Biosynthesis of glycogen, starch, sucrose, and other carbohydrates
* Coordinate regulation of glycolysis and gluconeogenesis
* Photosynthetic carbohydrate synthesis
* Regulation of carbohydrate metabolism in plants

The students are required to understand and remember the reactions of gluconeogenesis, including the enzyme and the coenzymes involved, especially those irreversible reactions, and how glycolysis and gluconeogenesis are coordinately regulated. They are also required to be familiar with the reactions and regulation of photosynthetic carbohydrate synthesis.

**Chapter 21---Lipid biosynthesis**

* Biosynthesis of fatty acids
* Biosynthesis of triacylglycerols
* Biosynthesis of cholesterol

The students are required to understand and remember the reactions of fatty acid biosynthesis, including the enzyme and the coenzymes involved, and the regulation of the pathway. They are also required to be familiar with the reactions and regulation of cholesterol biosynthesis.

**Chapter 22---Biosynthesis of amino acids, nucleotides, and related molecules**

* Overview of nitrogen metabolism
* Biosynthesis of amino acids
* Biosynthesis and degradation of nucleotides

The students are required to be familiar with the reactions of nitrogen fixation, the biosynthesis of different amino acids, and the biosynthesis and degradation of nucleotides. They are required to understand and remember the allosteric regulation of amino acid biosynthesis.

**Chapter 23---Hormonal regulation and integration of mammalian metabolism**

* Tissue-specific metabolism
* Hormonal regulation of metabolism
* Hormones: diverse structures for diverse functions

The students are required to understand and remember the specific functions of different tissues in metabolism, and the roles of different hormones, such as epinephrine, glucagon and insulin, in regulating metabolism.

**Part III---Information pathways**

**Chapter 24---Genes and chromosome**

* Chromosomal elements
* The size and sequence structure of DNA molecules
* DNA supercoiling
* Chromatin and nucleoid structure

The students are required to understand what a gene is. They are also required to be familiar with the structure of chromatin, nucleoid, and chromosome.

**Chapter 25---DNA metabolism**

* DNA replication
* DNA repair
* DNA recombination

DNA replication is the main topic of this chapter. The students are required to understand and remember the mechanism of DNA replication, including the stages and the enzymes and the proteins involved in each stage. They are also required to be familiar with the different types of DNA repair.

**Chapter 26---RNA metabolism**

* DNA-dependent synthesis of RNA
* RNA processing
* RNA-dependent synthesis of RNA and DNA

RNA transcription is the main topic of this chapter. The students are required to understand and remember the mechanism of RNA transcription, including the stages, the enzymes and the proteins involved in each stage. They are also required to be familiar with the different types of RNA processing and the reactions of reverse transcription.

**Chapter 27---Protein metabolism**

* The genetic code
* Protein synthesis
* Protein targeting and degradation

Protein synthesis is the main topic of this chapter. The students are required to understand how genetic code was discovered. They are required to understand and remember the mechanism of protein synthesis, including the stages and the enzymes and the proteins involved in each stage. They are also required to be familiar with protein targeting and degradation.

In addition to lectures, there will be office hour every Friday afternoon to answer the questions students may have. There will be quizzes, homework and the final exam, which will account for 20%, 20% and 60% of the final grade, respectively.