UNIVERSITY OF DIYALA
COLLEGE OF MEDICINE
DEPT. OF CHEMISTRY AND BIOCHEMISTRY

SYLLABUS OF

MEDICAL CHEMISTRY AND BIOCHEMISTRY

THEORY

1 st stage

2026 -2027

INDEX

Contents **page number**

- Vision, message and objectives of the branch 3
- Credit hours & Learning units 4
  Theory Exam
  Practical Exam

- First semester 5

1. Fluid and Electrolyte Balance 6
2. Chemistry of Carbohydrates 7
3. Fatty acids & lipids 8
4. Amino Acids 9
5. Proteins 10
6. Nucleic Acids 11

- Second semester 12

1. Enzymes Part 1 13
2. Enzymes Part 2 14
3. Introduction to Carbohydrate metabolism 15
4. Glycolysis & TCA Cycle 16
5. Gluconeogenesis 17
6. Glycogen metabolism 18
7. Diabetes Mellitus 19
8. Pentose phosphate pathway & Ethanol metabolism 20

- Teaching and learning methods & Teaching Tools 21
- Students assessment methods & Questions include 22
- Marks of theory , practical 23
- Reference 24
- Department Teaching Staff 25

Vision, message and objectives of the branch:

Vision:

1. Actively contribute to medical progress through education and prepare qualified doctors to provide the best medical services and continue scientific research in all medical fields.
2. The preparation of doctors with competence and scientific experience enhanced by understanding the biochemical foundations of vital processes that occur within the human body in normal and pathological cases.

Message:

1. Excellence in the innovation and follow-up of advanced scientific methods in the conduct of pathological analyses and the preparation of medical scientific research that contributes to the service of the community.
2. Establishing sober relationships with researchers at international universities.

Goals:

1. Keeping up with the scientific development in the development of education programs and using the latest programs developed for medical education in accordance with the modern academic curriculum.
2. Contribute to providing the community with scientifically distinguished doctors with experience in the scientific foundations adopted to conduct all clinical biochemistry analyses.
3. Lectures for graduate students at university colleges as well as supervising their research projects.

Credit hours :

Theory hours of the year : 90

Theory hours of the course : 45

Practical hours of the year : 60

Practical hours of the course : 30

Theory Exam :

Mid year exam : is a 2 hrs .

Final year exam : is a 3 hrs .

Practical Exam :

Mid year exam : is a 2 hr .

Final year exam : is a 3 hrs .

Learning units :

Units of teaching of the year : 8

Units of teaching of the course / Theoey : 6

Units of teaching of the course / Practical : 2

first

Semester

Total weeks of the course : 15

Theory hours of the course : 45

Theory hours / week : 3

Units of teaching: 3

First Subject **(6 hours)**

Fluid and Electrolyte Balance

Objectives

1. Define body fluid and electrolytes.
2. Know the volumes and main composition of body fluids.
3. List the factors that determine body water content and describe the effect of each factor.
4. Describe the role of the body systems in regulating the body's fluid composition and volume.
5. Describe mechanisms that regulate water intake and hormonal controls of water output in urine.

Second Subject **(6 hours)**

Chemistry of Carbohydrates

Objectives

1. Define carbohydrate and the groups of saccharides
2. Know the chemical structure of the common sugars.
3. Understand the concepts of and isomerism in simple sugars anomers.
4. Glycosides, sugar alcohols, sugar acids, phosphate esters, deoxy sugars and amino sugars.
5. Understand the role saccharides play in biology
6. Know the biochemical functions and differences between the various heteropolysaccharides
7. Be able to recognize the N and O linked polysaccharides
8. Know how dietary polysaccharides are digested by humans

Third Subject **(9 hours)**

Fatty acids & lipids

Objectives

1. Have general idea about lipid structure and properties
2. Classify lipids
3. List the major physiological functions of fatty acids
4. Derive the structure of saturated or unsaturated fatty acids.
5. Study the relation between the structure and function of fatty acids
6. List and be able to identify the general features of the ecosanoids.
7. Know the biochemical functions of the eicosanoids
8. Know the mean class of lipids
9. Understand the physical and chemical of the classes.
10. List the biological function of all classes.
11. Relate the structure and properties with the diseases come as a result of this lipids.

Fourth Subject **(9 hours)**

Amino Acids

Objectives

1. Describe the general structure of an amino acid.

2. Recognize amino acids and classify them based on the characteristics of their side chains.

3. List the twenty common amino acids found in living organisms.

4. Describe how a peptide bond forms.

5. Understand the biologic activities of peptides

6. Know that the side-chains (R groups) of the amino acids can interact with one another to fold the protein into a particular shape which is essential for the protein to function correctly.

7. Understand that each protein molecule can be hundreds of amino acids long and the amino acids must be joined in a precise order.

8. Know that the side-chains (R groups) of the amino acids can interact with one another to fold the protein into a particular shape which is essential for the protein to function correctly.

Fifth Subject **(9 hours)**

Proteins

Objectives

1. Classify proteins according to different parameters including chemical composition, shape, biological function, solubility in water.

2. Describe, using examples, the relationship between protein structure and function

3. Explain of biological activity of some important proteins

4. Define denaturation and list factors led to protein denaturation

5. List some medical application of denaturation

Sixth Subject **(6 hours)**

Nucleic Acids

Objectives

1. Describe the structure of a nucleotide as being a phosphate group, pentose sugar (either ribose or deoxyribose), and a nitrogen containing base,

2. State that a nucleic acid is formed from many nucleotides, joined by condensation reactions,

3. Compare and contrast the structures of DNA and RNA,

4. Explain the importance of DNA in storing genetic material and safely transferring genetic information between organisms**.**
5. Comprehend the universal nature of the gene.

6. Be able to define replication of DNA.

7. Know the roles of mRNA, ribosomes, tRNA and amino acids in the process of translation.

8. Understand what start codons and stop codons are.

9. Know that ribosomes consist of a large and a small subunit and be able to define polysome.

Second Semester

Total weeks of the course : 15

Theory hours of the course : 45

Theory hours / week : 3

Units of teaching: 3

First Subject **(6 hours)**

Enzymes
Part 1

Objectives

1. Define enzyme and explain basic functions of enzymes
2. Explain basic properties of enzymes
3. Discover and defines the enzyme components
4. Express localization of enzymes in the cell
5. Defines the active site and catalytic activity of enzyme
6. Discuss working principle of enzymes
7. Express the relationship between enzyme and substrate

Second Subject **(6 hours)**

Enzymes
Part 2

Objectives

1. Explain what an enzyme inhibitor is.
2. Distinguish between reversible and irreversible inhibitors.
3. Differentiate between competitive and noncompetitive inhibitors.
4. Discuss the biological role of isoenzymes and their use in clinical diagnosis.
5. Understand the bases of enzyme catalysis and the mechanisms of enzyme regulation.
6. Know the role of regulatory enzymes in controlling metabolic pathways and cellular responses.

Third Subject **(3 hours)**

Introduction to Carbohydrate metabolism

Objectives

1. Identify the major saccharides found in the human body and diet.
2. What is the process of carbohydrate metabolism.
3. Draw diagram of how glucose transported across intestinal epithelial cells and into the blood stream and describe the protein involved.

Fourth Subject (6 hours)

Glycolysis & TCA Cycle

Objectives

1. Describe the overall purpose of glycolysis, its cellular reactants and products, its cellular localization and its tissue distribution.

2. Differentiate the roles of hexokinase and glucokinase in blood glucose regulation .

3. Describe the purpose of the reaction catalyzed by LDH.

4. Predict the results of a CBC in a person with PK deficiency who is in hemolytic crisis.

5. Explain the biochemical basis of the hemolytic anemia observed in deficiency of erythrocyte pymvate kinase.

6. Describe the overall purpose of the TCA cycle, its reactants and products, its cellular localization and its tissue distribution.

7. Describe the role of the TCA Cycle intermediates as sources of reactants for biosynthetic pathways.

Fifth Subject **(6 hours)**

Gluconeogenesis

Objectives

1. Differentiate the enzymes involved in glycolysis and gluconeogenesis.

2. Explain the contribution of gluconeogenesis to blood glucose regulation.

3. Evaluate the relative importance of different precursors for gluconeogenesis in feeding, fasting and exercise.

4. Describe the overall purpose of gluconeogenesis, its reactants and products, its cellular localization, and its tissue distribution.

Sixth Subject **(6 hours)**

Glycogen metabolism

Objectives

1. Describe the overall purpose of gluconeogenesis and glycogenolysis, their reactants and products, their cellular localization and their tissue distribution.

2. Explain how glycogen synthesis and glycogenolysis are regulated by insulin, glucagon and catecholamine's.

3. Select laboratory tests that would contribute to the diagnosis of glycogen storage disease.

Seventh Subject **(6 hours)**

Diabetes Mellitus

Objectives

1. Compare and contrast type 1 and type 2 diabetes mellitus with respect to incidence, age of onset and distinguishing characteristics.

2. Describe abnormalities in blood glucose homeostasis in patients with type 1 diabetes.

3. Recognize the clinical presentation of type 1 diabetes mellitus.

4. Discuss how lifestyle factors impact the development of type 2 diabetes.

Eigth Subject **(6 hours)**

Pentose phosphate pathway
&
Ethanol metabolism

Objectives

1. Describe the overall purpose of the PPP, its reactants and products and its cellular localization.

2. Describe the role of reduced glutathione in the body.

3. Explain the biochemical basis of the drug induced hemolytic anemia observed in G6PD deficiency.

4. Select laboratory tests used to diagnose G6PD deficiency.

5. Identify the metabolic products of ethanol metabolism including acetyl CoA .

6. Evaluate the metabolic effects and clinical significance of ethanol and its metabolites.

7. Explain the biochemical basis for the effects of alcohol ingestion on gluconeogenesis.

8. Generate aproblem list with potential biochemical causes of hypoglycemia , hepatomegaly or lactic acidosis.

Teaching and learning methods :

1. Method of givin lectures .
2. Student groups .
3. Workshops .
4. Reports & Research

Teaching Tools :

1. Screen LCD .
2. Data show .
3. For experimental part **:**
    a. Spectrophotometer .
    b. Centrifuge .
    c. Water bath .
    d. Incuvate .
    e. Test tubes .
    f. Syringes .

Students assessment methods:

1. Examination .
2. Reports preparation .

Questions include:

1-MCQs.√

2-Single choice questions. √

3-Matching. √

4-(Modified)Essay questions√

5-etc……

Marks of theory , practical :

Total marks

- Theory : **75 %**
- Practical : **25 %**

First course Examination

- Theory : **15**
- Practical : **5**

Second course Examination

- Theory : **15**
- practical : **5**

Final Examination

- Theory : **45**
- Practical : **15**

Reference :

- Lippincott Illustrated Reviews : Biochemistry , Seventh Edition , 2018 .

- Harper’s Biochemistry , 31 ST Edition , 2018 .

- Lehninger Principle of Biochemistry , 4 th Edition , 2005 .

- Essentials of Medical Biochemistry with clinical cases , 3 rd Edition , 2022 . By N.V. Bhagavan and chury – Eun Ha .

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