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

SYLLABUS OF

MEDICAL CHEMISTRY AND BIOCHEMISTRY

THEORY

1 st stage

2023-2024

INDEX

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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)**

Acid-Base Balance

Objectives

1. Defines acids, bases.
2. Know the natural acids and bases ratio of the body.
3. Recognize the types of acid and base.
4. List the source of acids and bases of the body.
5. Study the systems responsible for maintenance of the acid-base balance.
6. Explain the role of buffer systems in regulating the pH of the intracellular fluid and the extracellular fluid.
7. Discuss acid base disorders
8. Analysis of Acid-Base Imbalances Report

Third Subject **(9 hours)**

Chemistry of Carbohydrates-1 Monosaccharides & Disaccharides

Objectivses

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

Fourth Subject **(9 hours)**

Chemistry of Carbohydrates-Polysaccharides Part-2

Objectives

1. Study the chemical structure of polysaccharides
2. Classify polysaccharides
3. Know the biochemical functions and differences between the various heteropolysaccharides
4. Be able to recognize the N and O linked polysaccharides
5. Know how dietary polysaccharides are digested by humans

Fifth Subject **(9 hours)**

Fatty acids & Derivatives

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. Be able to specify the omega or delta ends. Recognize the alpha, beta and gamma carbons of fatty acids
7. List and be able to identify the general features of the ecosanoids.
8. Know the biochemical functions of the eicosanoids

Sixth Subject **(6 hours)**

Glyceride , Non-glyceride & Complex lipids

Objectives

1. Classify lipids.
2. Know the mean class of lipids
3. Have an idea about the structure of each class.
4. Understand the physical and chemical of the classes.
5. List the biological function of all classes.
6. Relate the structure and properties with the diseases come as a result of this lipids.

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)**

Amino Acids & Proteins
Part 1

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

Second Subject **(6 hours)**

Amino Acids & Proteins
Part 2

Objectives

1. Understand that amino acids are linked via peptide bonds to make polypeptides and proteins

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

3. 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.

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

5. Define denaturation and list factors led to protein denaturation

6. List some medical application of denaturation

Third Subject **(3 hours)**

Amino Acids & Proteins
Part 3

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

Fourth Subject **(6 hours)**

Nucleic Acids
Part 1

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. Recall that the nitrogenous bases are adenine, cytosine, guanine, and thymine in DNA, or uracil in RNA, and the base pairings that occur,

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

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

5. Explain the importance of DNA in storing genetic material and safely transferring genetic information between organisms.

Fifth Subject **(6 hours)**

Nucleic Acids
Part 2
Protein Biosynthesis

Objectives

1. Comprehend the universal nature of the gene.
2. Be able to define replication of DNA.
3. Know the roles of mRNA, ribosomes, tRNA and amino acids in the process of translation.
4. Understand what start codons and stop codons are.
5. Understand how a polypeptide is built, one amino acid at a time, in the different docking sites of the ribosome.
6. Understand how tRNAs are ‘charged’ with amino acids.
7. Know that ribosomes consist of a large and a small subunit.
8. Be able to define polysome.

Sixth Subject **(6 hours)**

Nucleic Acids
Part 3

Objectives

1. Define how errors by DNA polymerase create mutations
2. Identify the types of gene mutations.
3. Describe what occurs during each type of mutation.
4. Explain the structure and shape of viruses.
5. Know the viral replication, viral transaction and viral protein biosynthesis.
6. Discuss how to prevent viral transaction and viral protein biosynthesis

Seventh 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

Eigth 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.

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 .

Department Teaching Staff :

- Name Prof. Dr. Salih Mahdi Salman
  E:mail waamrs@yahoo.com
  Phone no. 07719608316

- Name Lec. Dr. amar ahmmed hussein
  E:mail a.biochem21@gmail.com
  Phone no. 07700038902

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Total weeks of the course : 15

Practical hours of the course : 30

Practical hours / week : 2

Units of teaching: 1

First Week **(2 hours)**

Laboratory safety

Objectives

a. Understand the proper laboratory safety.

b. Increase the awareness of the possible risks or hazards involved with laboratory work.

c. Realize the laboratory is generally a safe place to work if safety guidelines are properly followed.

Second Week **(2 hours)**

Laboratory instruments and apparatuses

Objectives

a. Identify and categorize the different instruments and apparatuses with their parts and uses in practice .

b. Identify the photometer with its main parts and uses

Third Week **(2 hours)**

Units and references values

Objectives

a. Recognize the principles of photometry and the related laws.

b. Measure weight and volume

Fourth Week **(2 hours)**

Applications of spectrophotometers

Objectives

a. Learn the purpose and proper use of a spectrophotometer.

b. Determine the relationship between light absorbance and the number of particles in a sample in a given volume.

c. Apply different methods for expressing concentration .

d. Prepare stock solutions and perform different dilutions

Fifth Week **(2 hours)**

Blood components

Objectives

a. Describe the blood components in details.

b. Explain the blood samples in details.

Sixth Week **(2 hours)**

Preparation of plasma and serum for analysis

Objectives

a. Describe the blood samples in details.

b. Outline the importance of blood samples.

Seventh Week **(2 hours)**

Sample collection, processing and handling

Objectives

a. Outline the type of biological samples .

b. Describe the Blood collection techniques .

Eigth Week (2 hours)

pH and Buffer, Acid- Base Balance

Objectives

a. Explain the acid base balance.

b. Describe the role of buffers in maintaining the pH of a solution in body fluids.

Ninth Week **(2 hours)**

Buffers in blood

Objectives

a. Identify the most powerful buffer systems in the body.

b. Outline the importance of the buffer systems.

Tenth Week (2 hours)

Urinalysis (UA)

Objectives

a. Outline the importance of urine samples

b. Describe the collection of urine samples

c. Describe urine examinations

Eleventh Week **(2 hours)**

Analysis of normal constituents of urine

Objectives

a. Describe the content of normal urine samples.

b. Explain the results of urine examinations.

Twelfth Week (2 hours)

Analysis of abnormal constituents of urine

Objectives

a. Describe the content of abnormal urine samples.

b. Explain the results of urine examinations for different cases.

Thirteenth Week **(2 hours)**

General stool examination

Objectives

a. Outline the importance of stool samples

b. Describe the collection of stool samples

c. Describe stool examinations

Fourteenth Week (2 hours)

Hematological test

Objectives

a. Outline the importance of hematological test

b. Explain the hematological test

Fifteenth Week **(2 hours)**

First- semester examination

second Semester

Total weeks of the course : 15

Practical hours of the course : 30

Practical hours / week : 2

Units of teaching: 1

First Week **(2 hours)**

Blood Glucose Test

Objectives

a. Identify the principles of the blood glucose test

b. Calculation of glucose concentration in the unknown sample

Second Week (2 hours)

Oral Glucose Tolerance Test

Objectives

a. Explain the types of the blood glucose tests

b. Define the Oral Glucose Tolerance Test

Third Week **(2 hours)**

Diabetes mellitus

Objectives

a. Describe diabetes mellitus.

b. Explain its diagnosis and classification.

Fourth Week **(2 hours)**

Case scenario of diabetes mellitus (Type I)

Objectives

a. Describe Type I diabetes mellitus.

b. Illustration of case studies on Type I Diabetes Mellitus.

Fifth Week **(2 hours)**

Case scenario of diabetes mellitus (Type II)

Objectives

a. a. Describe Type II diabetes mellitus.

b. Illustration of case studies on Type II Diabetes Mellitus.

Sixth Week **(2 hours)**

Lipid Profile

Objectives

a. Identify the principles of the lipid profile test

b. Calculation of total cholesterol concentration in the unknown sample

Seventh Week **(2 hours)**

Lipoproteins

Objectives

a. Identify the lipoproteins

b. Estimate the concentration of HDL and LDL in the unknown sample

Eigth Week **(2 hours)**

Plasma lipids and lipoproteins

Objectives

a. Describe disorders of lipid metabolism

b. Illustration of case study

Ninth Week **(2 hours)**

Case scenario of hypercholesterolemia

Objectives

a. Describe hypercholesterolemia.

b. Illustration of case studies on hypercholesterolemia.

Tenth Week **(2 hours)**

Case scenario of hypercholesterolemia in patients with diabetes mellitus

Objectives

a. Describe hypercholesterolemia in patients with diabetes mellitus .

b. Illustration of case studies on hypercholesterolemia in patients with diabetes mellitus.

Eleventh Week **(2 hours)**

Triglycerides

Objectives

a. Identify the principles of the triglycerides test

b. Calculation of TG concentration in the unknown sample

Twelfth Week **(2 hours)**

Case scenario of hyperlipidaemia

Objectives

a. Describe hyperlipidaemia .

b. Illustration of case studies on hyperlipidaemia .

Thirteenth Week **(2 hours)**

Case scenario of hyperlipidaemia in patients with diabetes mellitus

Objectives

a. Describe hyperlipidaemia in patients with diabetes mellitus .

b. Illustration of case studies on hyperlipidaemia in patients with diabetes mellitus.

Fourteenth Week **(2 hours)**

Case scenario of hypercholesterolemia and hyperlipidaemia in patients with diabetes mellitus

Objectives

a. Describe hypercholesterolemia and hyperlipidaemia in patients with diabetes mellitus .

b. Illustration of case studies on hypercholesterolemia and hyperlipidaemia in patients with diabetes mellitus .

Fifteenth Week **(2 hours)**

Second-semester examination

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Department Teaching Staff :

- Name Lec. Dr. amar ahmmed hussein
  E:mail a.biochem21@gmail.com
  Phone no. 07700038902

- Name Assist. Lec. yasmine sami naser
  E:mail yasamin@uodiyala.edu.iq
  Phone no. 07817571531

- Name Assist. Lec. wasan saher hassan
  E:mail wasans.hassan2018@yahoo.com
  Phone no. 07713846994

- Name Assist. Lec. Rusul adnan abass .
  E:mail rusul.a@uodiyala.edu.iq
  Phone no. 07703663940

- Name Assist. Lec. deine majeed qader .
  E:mail deine.m@uodiyala.edu.iq
  Phone no. 07714868736

- Name Assist. Lec. ismail khaleel abed .
  E:mail ismail.kh@uodiyala.edu.iq
  Phone no. 07818832209