



**Department of Chemistry**

**College of Education**

**University of Salahaddin**

**Subject: Enzymes, Homones, Metabolism**

**Course Book – (Year 2) (semester II)**

**Lecturer's name: Lutfia Muhamad Hassan**

**Academic Year: 2023/2024**

## Course Book

1. Course name	Biochemistry
2. Lecturer in charge	Assistant Prof.Lutfia Mohammad Hassan
3. Department/ College	Chemistry/ Education
4. Contact	e-mail: lutfia.hassan@su.edu.krd Tel: 0750 4824623
5. Time (in hours) per week	Theory: 2 Practical: 9
6. Office hours	Tuesday: 9am-1pm
7. Course code	
8. Teacher's academic profile	<p><b>Educational background:</b></p> <p>1980- 1981: B.sc in chemistry, college of Education, university of Sulemanya.</p> <p>2000-2001: M.sc in Clinical Biochemistry, College of Education, University of Salahaddin.</p> <p><b>Academic experience:</b></p> <p>Since 2004, I have worked asa teaching staff at the University of Salahaddin, and started teaching Biochemistry for undergraduate students in the department ofChemistry, college of Education. It includes both theoretical and practical areas. In addition, during this time I havepublished certain publications.</p> <p><b>Skills and professions:</b></p> <p>Throughout my previous experience in the field, I have acquired the skills for working in accordance to the provided curriculum, and to obtain the important information to my students. Also, I have got researchexperiences in the field of Biochemistry.</p>

<b>9. Keywords</b>	
<b>10. Course overview:</b>  <p>This course surveys the structure, function, and metabolism of amino acids, proteins, carbohydrates, lipids, and nucleic acids. It introduces the concepts in cell structure, replication and growth, and metabolic regulation. By focusing on metabolic pathways, cycles, and control mechanisms. In addition, it will cover bioenergetics and metabolism of carbohydrates, lipids, amino acids and nucleotides.</p>	
<b>11. Course objective:</b>  <p>To understand the kinetics and mechanisms of action of enzymes, to become familiar with the basic methods of studying enzymes, and to appreciate how individual reactions are controlled and integrated into the metabolic pathways of the cell. Acquired theoretical and experimental knowledge will enable students to find appropriate employment in different development, scientific-research laboratories, or to continue their further studies in biochemistry or related disciplines.</p> <p>The objective of this course is to indicate how central metabolism and energy conservation used as a resource of understanding biological methods in general and developing problem solving skills in biochemistry. Thirdly, it provides a fundamental knowledge about the macromolecules and metabolic pathways of prokaryotes and eukaryotes, with assertion of how works in human body systems.</p>	
<b>12. Student's obligation</b>  <p>Sure, students play a significant role throughout the course. Based on that, there is a kind of deal between us, that all the students are obliged to attend the classes, both the theoretical and practical in the lab, during the academic year. However, they are frequently allowed not to attend the class, in in some urgent cases. Additionally, students are encouraged to see and ask me for clarifications during my office hours. Due to the previous experience, the student which has a regular attendance and look for more detailed clarification, are obtained a better result than those do not.</p> <p>Additionally, all the exams, assignments and reports are obligatory required from the students during the academic year 2022/2023. Since they help to evaluate the students' achievements during the course and show the area of weakness of individual that need to be developed throughout the course.</p>	

### **13. Forms of teaching**

During the classes, different equipments are used. For example, showing the information through power point slides by data show and sometimes the white board is used as well for giving more clarification and details to the students.

### **14. Assessment scheme**

There will be a variety of assessments consisting of homework, presentations, and in-class assessments,

#### **Marking System**

The grades for each piece of assessed work are as follows:

- 90-100 % is excellent
- 80-89% is very good
- 70-79% is good
- 60-69% is a moderate pass
- 50-59% is a pass

### **15. Student learning outcome:**

Upon successful completion of this course, students should be able to: explain relationship between the structure and function of enzymes; explain how enzymes are able to increase speed of an biochemical reaction in sense of thermodynamics, kinetics and molecular interactions; use catalytic strategies in interpreting mechanisms of enzymatic action; interpret and explain significant mechanisms of regulation of enzymatic action and specifies importance of enzymes in regulation of metabolism; apply appropriate methods for determination of catalytic parameters and activity of enzymes and resolve problems considering kinetics and thermodynamics of enzymatic reactions; analyze options for applying enzymes and their inhibitors in medicine and various industries; apply theoretical, practical, IT and statistical knowledge during processing experimental results and their correct

### **16. Course Reading List and References:**

**The relevant sources to this course are:**

1. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications (2012).
2. Biochemistry VII Edition; Jeremy M Berg, John L Toymoczko and Lubert Stryer, W H Freeman and Co. (2010).
3. Physical Biology of the Cell, 2nd Edn. Rob Phillips, Jane Kondev, Julie Theriot, Hernan Garcia, Garland Publishers (2012).
4. Biochemistry; Voet, D. and Voet, J.G. [Eds.] 3rd Ed. Jhon Wiley and sons, (1999).
5. Biochemistry; David Rawn, J, Neil Patterson Publishers (1989).
6. Complex Carbohydrates, Sharon, N. Addison Wisely, (1975).
7. Methods of Enzymatic Analysis; Berg Meyer Vol. 1-X, (1974).
8. Nucleic acid Biochemistry and Molecular Biology, Mainwaring et al., Blackwell Scientific (1982).
9. Principles of Biochemistry; Smith et al., McGraw Hill (1986).
10. Proteins Structures and Molecular Properties 2nd Edn. Thomas E. Creighton, W H Freeman and Co. (1993).
11. Principles of Protein Structure, Function, & evolution, Dickerson & Geis, 2 nd Ed. Benjamin-Cummings (1983).
12. Biochemistry Ed. Donald Voet & Judith G. Voet, John Wiley & Sons Inc.(2010). 13. Practical Biostatistics; Mendel Suchmacher and Mauro Geller, Academic Press (2012)

Online at <http://www.ncbi.nlm.nih.gov>

- <https://www.bio.cmu.edu/courses/BiochemMols/TCACycle/TCAMain.htm>

17. The Topics:	Lecturer's name
<p><b>Unit-I:</b></p> <p><b>Enzymology</b> .Introduction to Biocatalysis, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Active site, Enzyme specificity. Principles of energy of</p>	<p>Assistant Prof .Lutfia</p>

<p>activation, transition state. Interaction between enzyme and substrate-lock and key, induced fit models. Fundamentals of enzyme assay, enzyme units. Outlines of mechanism of enzyme action, factors affecting enzyme activity. Commercial application of enzymes.</p> <p><b>Unit- II:</b></p> <p><b>Bioenergetics and Biological oxidation 12 hours</b> Bioenergetics: Thermodynamic principles ñ Chemical equilibria; free energy, enthalpy (H), entropy (S). Free energy change in biological transformations in living systems; High energy compounds. Energy, change, oxidation-reduction reactions. Organization of electron carriers and enzymes in mitochondria. Classes of electron-transferring enzymes, inhibitors of electron transport. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation. Mechanism of oxidative phosphorylation.</p> <p><b>Unit-III:</b></p> <p><b>Carbohydrate Metabolism.</b> Concept of anabolism and catabolism. Glycolytic pathway, energy yield. Fate of pyruvateformation of lactate and ethanol, Citric acid cycle, regulation, energy yield, amphipathic role. Anaplerotic reactions. Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis. Photosynthesis- Light and Dark reactions, Calvin cycle, C4 Pathway. Disorders of carbohydrate metabolism- Diabetes Mellitu</p> <p><b>Unit-IV:</b></p> <p><b>Lipid Metabolism.</b> Catabolism of fatty acids (<math>\beta</math>- oxidation) with even and odd number of carbon atoms, Ketogenesis, DE NOVO synthesis of fatty acids, elongation of fatty acids in mitochondria and microsomes, Biosynthesis and degradation of triacylglycerol and lecithin. Biosynthesis of cholesterol. Disorders of lipid metabolism.</p> <p><b>Unit-V:</b></p> <p><b>Metabolism of Amino acids</b> General reactions of amino acid metabolism- transamination, decarboxylation and deamination,</p>	
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<p>Urea cycle and regulation, Catabolism of carbon skeleton of amino acids- glycogenic and ketogenic amino acids. Metabolism of glycine, serine, aspartic acid, methionine, phenylalanine and leucine. Biosynthesis of creatine. Inborn errors of aromatic and branched chain amino acid metabolism.</p> <p><b>Unit IX:</b></p> <p><b>Endocrinology .</b></p> <p>Endocrinology- organization of endocrine system. Classification of hormones. Outlines of chemistry, physiological role and disorders of hormones of thyroid, parathyroid, pituitary and hypothalamus. Introduction of gastrointestinal hormones. Mechanism of hormonal action- signal transduction pathways for glucocorticoids and insulin. Adrenalin, estrogen and progesterone.</p>	
<p><b>18. Practical Topics (If there is any)</b></p>	
	<p>AssitantProf.Lutfia</p>

## 19. Examinations:

### 1. Compositional:

**Complete each sentence or statement**

1. A reversible inhibitor that can bind to either E alone or the ES complex is referred to as a-----  
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2. During anaerobic metabolism of glucose in muscle, there is a net production in the cytosol of lactate and :
- 3.inhibitor alters the  $V_{max}$  of an enzyme.
- 4.Describes the velocity of reaction when all of the available substrate binding sites  
on an enzyme are occupied by substrate
5. Ketosis occurs at----- conditions
6. The triacylglycerol present in adipose tissue is hydrolyzed by:-----
- 7.In oxidative phosphorylation, the oxidation of one molecule of NADH produces-----ATP molecules:
8. Respiratory chain is found in:-----

**Describe the regulation of the following metabolic pathways (30M)**

- 1-Regulation of Gluconeogenesis
- 2-Regulation of De Novo Synthesis of Pyrimidine Nucleotides
- 3-Regulation of the Citric Acid Cycle
- 4- Regulation of the  $\beta$ -Oxidation of fatty acid

**20. Extra notes:**

## 21. Peer review