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KU4DSCZOO208: BIOCHEMISTRY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC	200	KU4DSCZOO208	3+1	60

Learning Approach (Hours/ Week)		Marks Distribution			Duration of ESE (Hours)
Theory/ Practical		CE	ESE	Total	
Theory	3	25	50	75	1.5
Practical	2	10	15	25	-

Course Description:

Biochemistry is the branch of science that explores the chemical processes within and related to living organisms. This course provides an in-depth examination of the molecular mechanisms underlying biological functions, emphasizing the structure, function, and regulation of biomolecules. Students will gain a comprehensive understanding of the fundamental principles governing cellular processes and their significance in health and disease

Course Prerequisite:

Course Outcomes:

	Expected Outcome	**Learning Domains**
CO1	Understand how living things work at a molecular level, including how cells use molecules like proteins, carbohydrates, fats, and DNA.	U
CO2	Apply this knowledge to solve simple problems and understand common laboratory techniques used in biochemistry.	A
CO3	Appreciate the importance of biochemistry in fields like medicine, agriculture, and environmental science.	An
CO4	Communicate basic biochemical concepts clearly, both in writing and verbally.	A
CO5	To introduce students to the basic principles of biochemistry	U

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	0	0	3	3	1
CO2	0	0	3	3	0
CO3	2	0	3	3	2
CO4	0	0	2	3	0
CO5	0	0	1	3	0

COURSE CONTENTS

Module I: Biochemistry and the living state (5 hr)

Unit I: Biochemistry and the living state

1.1 Mention micro, macro & trace elements/ mineral ions – their biological significance.
1.2 Water – molecular structure & dipolar nature, dissociation
1.3 Concept of pH, buffers
1.4 Henderson Hassel Bach equation; Biological functions of water.

Module II: Biomolecules (17hr)

Unit I

2.1 Classification of carbohydrates, Biological functions of carbohydrates
2.2 Classification of amino acids
2.3 Peptide bonds
2.4 Structural levels of proteins – primary, secondary, tertiary and quaternary structure.
2.5 Ramachandran plot.
2.6 Molecular chaperones.
2.7 Classification of proteins.
2.8 Biological importance of proteins and amino acids.

Unit II

2.9 Lipids. Basic structure and biological importance of lipids.
2.10 Classification of lipids.
2.10.1 Simple lipids – Fats, oils and waxes
2.10.2 Compound lipids - Phospholipids (lecithin, cephalin), Glycolipids (cerebrosides, gangliosides), Lipoproteins
2.10.3 Derived Lipids - Steroids (cholesterol)
2.10.4 Prostaglandins.
2.11 Nucleotides, Biologically important Nucleotides. Structure and importance of ATP, cyclic AMP, UTP, NAD, NADP, FMN, FAD.

Module III: Enzymes and Vitamins (10 hr)

Unit I: Enzymes and Functions

3.1 Enzymes- Classification and Nomenclature (IUB) – 6 major classes.
3.2 Concept of active sites
3.3 Mechanism of enzyme action (lock and key & induced fit hypothesis)
3.4 Factors influencing the velocity of enzyme action- effect of pH, temperature, enzyme and substrate concentration
3.5 Regulation of enzyme action- activation and inhibition (competitive, non competitive, allosteric and feedback)

Unit II: Vitamins and biological importance

3.6 Fat soluble and Water soluble vitamins (vitamin B (Thiamine, Riboflavin, Niacin, Pantothenic acid, Cyanocobalamin, Folic acid, Pyridoxin) and C.

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Module IV **(13 Hours)**

Unit 1

4.1 Basal metabolism- Calculation of BMR by Harris-Benedict formula;

4.2 Carbohydrate metabolism

- 4.2.1 Glycolysis
- 4.2.2 Glycogenolysis
- 4.2.3 Glycogenesis
- 4.2.4 Gluconeogenesis
- 4.2.5 Pentose Phosphate pathway
- 4.2.6 Kreb's cycle

4.3 Protein metabolism

- 4.3.1 Deamination
- 4.3.2 Transamination
- 4.3.3 Decarboxylation

4.4 Lipid metabolism

- 4.4.1 Oxidation of glycerol and fatty acids
- 4.4.2 Biosynthesis of fatty acids

(*Structural details of metabolic pathways are not expected*)

Unit II

4.5 Electron Transport System (ETS) and oxidative phosphorylation; Chemiosmotic hypothesis

Module V Practical **(30 hours)**

1. Qualitative tests for identification of carbohydrates, proteins and lipids.
2. To find the concentration of given solution using standard curve
3. Detection of abnormal constituents of urine (Glucose, albumin and ketone bodies
4. Separation of amino acids (or any other compounds) from a mixture by using
5. paper chromatography (Demonstration).
6. Detection of proteins: [Biuret test, Nitric acid test, Xanthoproteic test].
7. Detection of lipids: [Sudan III or IV test, Spot test].

Teacher Specific Module	**9 Hours**
Directions: **20 percent of the experiments can be modified by the course teacher**	

Essential Readings:

1. David L. Nelson and Michael Cox (2012): Lehninger Principles of Biochemistry 6th Edition, ISBN-10: 1429234148, W.H. Freeman, 1328 pages
2. David L. Nelson and Michael Cox (2017): Lehninger Principles of Biochemistry 7th Edition, ISBN-10: 1-4641-2611-9, W.H. Freeman, 1172 pages

3. David P. Plummer (2017)- Introduction to Practical Biochemistry, 3rd Edition, ISBN-10: 9780070994874, McGraw Hill Education, 498 pages
4. Donald Voet, Charlotte W. Pratt and Judith G. Voet (2001): Principles of Biochemistry 4th Edition, ISBN-10: 9780471417590, Wiley
5. Geoffrey L Zubay (1999): Biochemistry 4th Edition, ISBN-10: 0697219003, Wm. C. Brown Publishers, 1104 pages

Suggested Readings:

1. Biochemistry" by Lubert Stryer et al.
2. Molecular Biology of the Cell" by Bruce Alberts et.al

Assessment Rubrics:

Evaluation Type		**Marks**	
		Theory	**Practical**
1. End Semester Evaluation		50	15
2. Continuous Evaluation		25	10
Continuous Evaluation			
Theory/Practical	Method of Assessment	Marks	
Theory			
a)	Test paper I	5	
b)	Test paper II	5	
c)	Viva-Voce/Seminar/ Discussion	10	
d)	Assignment	5	
		Total – 25 marks	
Practical			
a)	Regularity/Punctuality	5	
b)	Laboratory skill	5	
		Total – 10 marks	

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