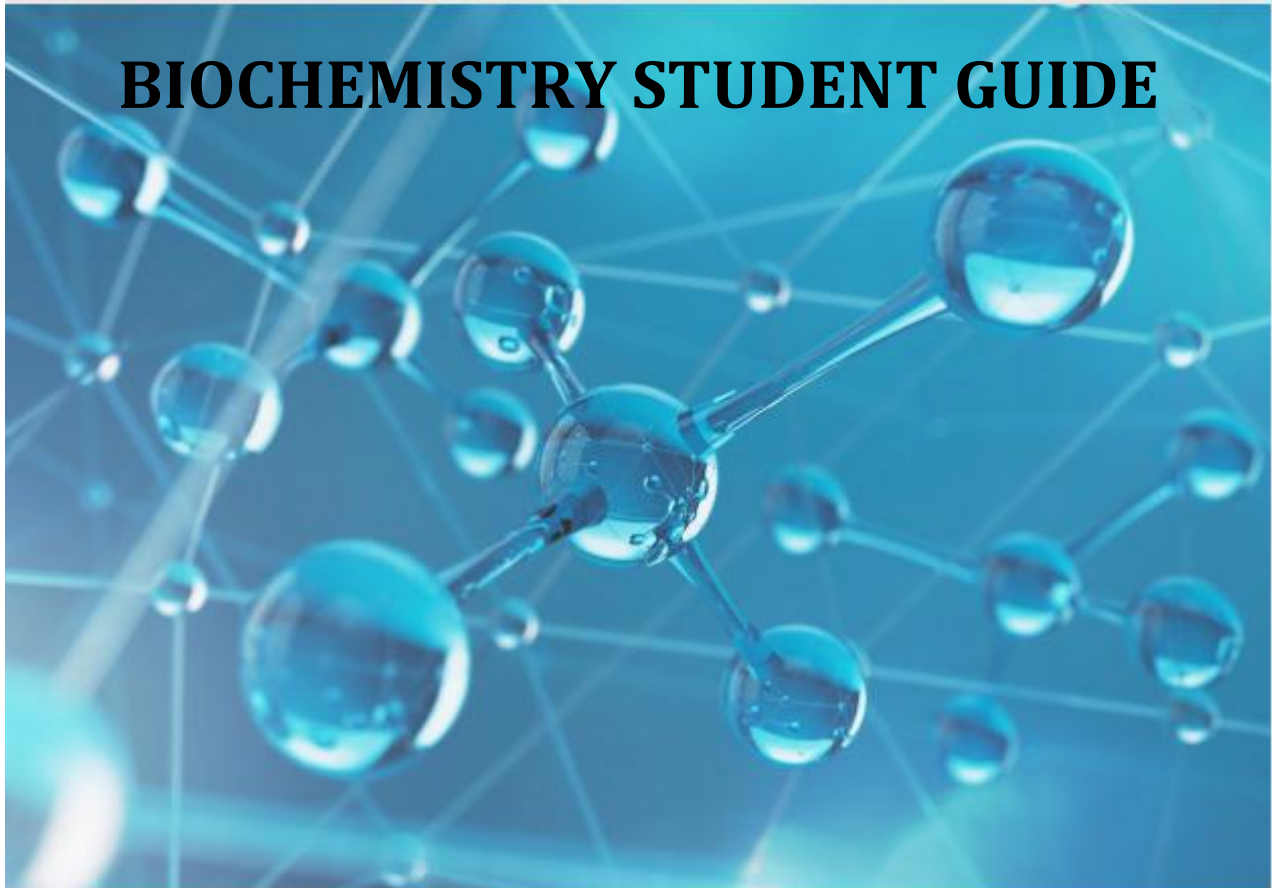




# **AZIZ FATIMAH MEDICAL & DENTAL COLLEGE**

## **BIOCHEMISTRY STUDENT GUIDE**



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### **BIOCHEMISTRY DEPARTMENT IN A GLANCE**

Biochemistry is the dynamic, exciting science in which chemistry is applied to the study of the atoms and molecules which comprise living organisms. This includes organic molecules

and their chemical reactions. It has revolutionized our understanding of and provides a backbone to modern medicine.

Biochemistry Department at Aziz Fatimah Medical & Dental College has a unique approach to the biochemical sciences that cultivates critical thinking as well as depth of knowledge by exposing its students to the full spectrum of modern biochemistry. The comprehensive teaching and assessment plan is strategically designed according to the UHS and PMC syllabi and guidelines to achieve maximum results.

The strength of Biochemistry Department is its conducive environment and committed staff. The vibrant teaching staff is highly qualified with post graduates degrees and certifications along with vast teaching experience. The department's aim is establishment of research culture and encouragement of student participation in it.

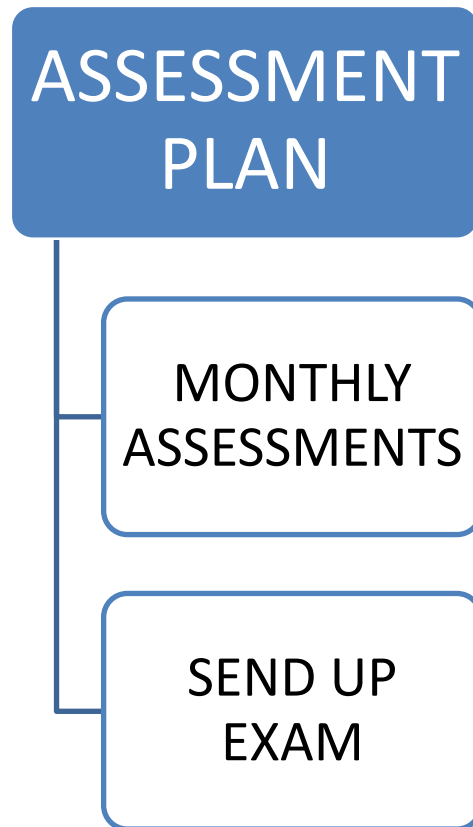
Biochemistry department has a well equipped laboratory and is managed by qualified and experienced technical staff. Practical training of the subject has been devised and the focus has been shifted to diagnostic biochemistry, in accordance with the UHS syllabi.

The department follows a proficient and result oriented teaching and assessment plan which includes new and interesting teaching strategies. Learning is made easy by increasing interactive student teacher sessions. Students are evaluated in cognitive, psychomotor and applied domains by conduction of regular formative and summative assessments like multiple choice questions, quizzes, written tests, assignments, presentations and OSPE and oral viva. At the end of each academic year a university standard send-up examination is conducted.

## Biochemistry Department Team-AFMDC

<b>Positions</b>	<b>Name</b>
<b>Head of Department</b>	Prof. Dr. Shakeel Ahmad
<b>Associate Professor</b>	Dr. Saira Saad
<b>Assistant Professor</b>	Dr. Sajjad Ghani
<b>Demonstrators</b>	Dr. Jameel Ahmad
	Dr. Huda
	Dr. Mehwish
	Dr. Urwah
<b>Laboratory Incharge</b>	Miss Qurat-ul-Ain
<b>Laboratory Assistant</b>	Mr. Saleem
<b>Computer Operator</b>	Mr. Ramzan

## Assessments



## LEARNING OBJECTIVES OF BIOCHEMISTRY

TOPIC	SUBTOPICS	LEARNING OBJECTIVES	LECTURE	SGD	PRACTICAL	
CARBOHYDRATE CHEMISTRY	<b>Monosaccharides</b>	<ul style="list-style-type: none"> <li>Define and classify carbohydrates.</li> <li>Discuss isomerism in monosaccharides.</li> <li>Discuss chemical and physical properties of carbohydrates.</li> <li>Discuss monosaccharides of biochemical importance.</li> </ul>	<b>5</b>		Qualitative analysis of carbohydrates	
	<b>Disaccharides</b>	<ul style="list-style-type: none"> <li>Discuss disaccharides of biochemical importance.</li> </ul>	<b>1</b>		Qualitative analysis of carbohydrates	
		<ul style="list-style-type: none"> <li>Discuss oligosaccharides of biochemical importance.</li> </ul>	<b>1</b>			
	<b>Polysaccharides</b>	<ul style="list-style-type: none"> <li>Discuss homopolysaccharides of biochemical importance.</li> </ul>	<b>1</b>			
		<ul style="list-style-type: none"> <li>Discuss heteropolysaccharides of biochemical importance.</li> </ul>	<b>1</b>			
	LIPID CHEMISTRY	<b>Fatty acids</b>	<ul style="list-style-type: none"> <li>Highlight Biological significance of lipids.</li> <li>Classify lipids.</li> </ul>	<b>1</b>		Qualitative analysis of carbohydrates
<ul style="list-style-type: none"> <li>Discuss fatty acids.</li> </ul>			<b>1</b>			
<b>Triacylglycerols</b>		<ul style="list-style-type: none"> <li>Discuss structure of TAGs.</li> <li>Identify chemical and physical properties of TAGs.</li> <li>Discuss lipid peroxidation</li> </ul>	<b>2</b>			
		<b>Phospholipids</b>	<ul style="list-style-type: none"> <li>Discuss structure, properties and significance of phospholipids.</li> <li>Describe lung surfactant, platelet activating factor and cardiolipin.</li> <li>Identify enzymes involved in degradation of phospholipids.</li> </ul>	<b>1</b>		
			<b>Glycolipids</b>	<ul style="list-style-type: none"> <li>Enlist types of glycolipids along with their significance and degradation.</li> </ul>	<b>1</b>	
<b>Eicosanoids</b>		<ul style="list-style-type: none"> <li>Discuss origin, half life, potency, functions and clinical significance of prostaglandins, thromboxanes and leukotrienes.</li> </ul>	<b>1</b>		Qualitative analysis of carbohydrates	

	<b>Cholesterol</b>	<ul style="list-style-type: none"> <li>Describe the role and properties of cholesterol and its related compounds (bile acids).</li> </ul>	<b>1</b>	
NUCLEOTIDE CHEMISTRY	<b>Nucleotides</b>	<ul style="list-style-type: none"> <li>Define nucleotides and nucleosides.</li> <li>Enumerate purine and pyrimidines along with their nucleosides and nucleotides.</li> <li>Identify biomedical importance of nucleotides.</li> <li>Discuss unusual bases.</li> <li>Explain role of bases as drugs.</li> <li>Discuss role of ATP.</li> </ul>	<b>2</b>	
	<b>Nucleic acids</b>	<ul style="list-style-type: none"> <li>Identify structural features of DNA.</li> <li>Identify types and structural features of RNA.</li> </ul>	<b>2</b>	Qualitative analysis of carbohydrates
		<ul style="list-style-type: none"> <li>UQs Discussion</li> </ul>	<b>1</b>	
CELL & SIGNAL TRANSDUCTION	<b>Types</b>	<ul style="list-style-type: none"> <li>Give organization and composition of eukaryotic and prokaryotic cells.</li> </ul>	<b>2</b>	
	<b>Cell membrane</b>	<ul style="list-style-type: none"> <li>Explain biochemical composition of cell membrane.</li> <li>Discuss membrane asymmetry, glycocalyx, blood group antigens.</li> <li>Identify importance of cholesterol in membranes.</li> </ul>	<b>1</b>	Qualitative analysis of carbohydrates
	<b>Transport across cell membrane</b>	<ul style="list-style-type: none"> <li>Describe diffusion (simple and facilitated), osmosis and osmotic pressure, transport of charged molecules and Gibbs-Donnan equilibrium.</li> <li>Outline Pores (aquaporins), channels and carriers.</li> </ul>	<b>2</b>	
	<b>Types</b>	<ul style="list-style-type: none"> <li>Discuss types of signals.</li> <li>Define gap junctions, autocrine, paracrine and endocrine signals.</li> </ul>	<b>1</b>	Qualitative analysis of

<b>Receptors</b>	<ul style="list-style-type: none"> <li>• Enlist various types of receptors.</li> <li>• Explain ligand gated ion channels, G-protein coupled receptors, Catalytic receptors and intracellular receptors.</li> <li>• Discuss receptor tyrosine kinases.</li> <li>• Classify G-proteins. Qualitative analysis of carbohydrates</li> </ul>	<b>2</b>	carbohydrates
<b>Second messengers</b>	<ul style="list-style-type: none"> <li>• Elaborate Adenylyl cyclase and cAMP cascade.</li> <li>• Explain Phospholipase and IP3, DAG cascade.</li> <li>• Discuss calcium calmodulin cascade.</li> </ul>	<b>2</b>	

TOPI C	SUBTOPI C	LEARNING OBJECTIVES	LECTURE	SGD	PRACTICAL
<b>WATER AND PH</b>	<b>Water</b>	<ul style="list-style-type: none"> <li>• Discuss the biomedical importance of water.</li> <li>• Identify water molecule as a dipole.</li> <li>• Discuss hydrogen bonding.</li> <li>• Explain properties of water as a solvent.</li> <li>•</li> </ul>	<b>1</b>	<b>1</b>	Introduction to use of laboratory facilities / equipment including safety measures
	<b>pH</b>	<ul style="list-style-type: none"> <li>• Define weak &amp; strong acids and bases.</li> <li>• Discuss ionization of water.</li> <li>• Define pH and pKa</li> <li>• Explain Henderson-Hasselbalch equation and its applications</li> <li>• Discuss titration curves of a weak acid and an amino acid.</li> <li>• Define zwitter ion and isoelectric pH.</li> </ul>	<b>2</b>		
	<b>Buffers</b>	<ul style="list-style-type: none"> <li>• Define buffers.</li> <li>• Elaborate bicarbonate and Hb buffer system.</li> <li>• Discuss transport of CO<sub>2</sub> and chloride shift.</li> <li>• Elaborate phosphate and protein buffer system.</li> </ul>	<b>2</b>	<b>1</b>	
	<b>Techniques</b>	<ul style="list-style-type: none"> <li>• Discuss pH metry &amp; isoelectric focusing</li> </ul>	<b>1</b>		<ul style="list-style-type: none"> <li>• Solutions &amp;Pr</li> </ul>



PROTEIN CHEMISTRY	<b>Amino acids</b>	<ul style="list-style-type: none"> <li>Define Amino acid.</li> <li>Discuss optical forms of amino acids.</li> <li>Identify the biomedical importance of amino acids.</li> <li>Classify amino acids.</li> </ul>	2	1	separation of solutions
	<b>Proteins</b>	<ul style="list-style-type: none"> <li>Classify proteins.</li> <li>Discuss peptide bond.</li> <li>Discuss primary &amp; secondary structure of protein.</li> <li>Discuss tertiary structure of protein.</li> <li>Elaborate protein folding.</li> <li>Identify protein misfolding diseases</li> </ul>	5		<ul style="list-style-type: none"> <li>Introduction and conversion of conventional and SI measuring units.</li> </ul>
	<b>Plasma proteins</b>	<ul style="list-style-type: none"> <li>Discuss structure, types and biomedical significance of plasma proteins.</li> </ul>	4		
	<b>Protein separation techniques</b>	<ul style="list-style-type: none"> <li>Chromatography</li> <li>Electrophoresis</li> <li>Centrifugation</li> </ul>	3		<ul style="list-style-type: none"> <li>Tests to detect proteins / peptides / amino acids</li> </ul>
EXTRACELLULAR MATRIX	<b>Collagen</b>	<ul style="list-style-type: none"> <li>Identify the components of extracellular matrix.</li> <li>Enlist types of collagen.</li> <li>Discuss the structure of collagen.</li> <li>Identify the steps in synthesis of collagen.</li> <li>Discuss collagen degradation.</li> <li>Discuss collagenopathies.</li> </ul>	2		
	<b>Elastin &amp; Keratin</b>	<ul style="list-style-type: none"> <li>Discuss the structure and synthesis and diseases of elastin .</li> </ul>	2		Tests to detect proteins /

	<ul style="list-style-type: none"> <li>Identify the role of <math>\alpha</math>1-antitrypsin in elastin degradation</li> <li>Discuss keratin.</li> </ul>		peptides / amino acids
	<b>Structural proteoglycans</b> <ul style="list-style-type: none"> <li>Discuss Fibronectin and Laminin</li> <li>Discuss proteoglycans.</li> </ul>	2	
	<b>GAGs</b> <ul style="list-style-type: none"> <li>Discuss the structure and functions of glycosaminoglycans GAGs .</li> <li>Discuss muco-polysaccharidosis.</li> </ul>	2	
HEMOGLOBIN, HEME METABOLISM & PORPHYRIN	<b>Porphyri ns</b> <ul style="list-style-type: none"> <li>Identify the structural features of porphyrins.</li> <li>Enlist haem proteins.</li> <li>Identify the site of haem synthesis.</li> <li>Discuss rate limiting step of haem synthesis alongwith its regulation.</li> </ul>	2	Tests to detect proteins / peptides / amino acids
	<b>Haem</b> <ul style="list-style-type: none"> <li>Discuss rate limiting step of haem synthesis along/with its regulation.</li> <li>Elaborate the haem synthetic pathway.</li> </ul>	4	
	<ul style="list-style-type: none"> <li>Discuss porphyrias.</li> </ul>		
	<ul style="list-style-type: none"> <li>Identify haem degradative pathway.</li> <li>Discuss hyperbilirubinemias causing jaundice.</li> </ul>		
	<b>Hemoglo bin</b> <ul style="list-style-type: none"> <li>Discuss structure of myoglobin and hemoglobin.</li> <li>Discuss various types of hemoglobin.</li> <li>Elaborate the binding of oxygen to hemoglobin.</li> <li>Discuss Factors Effecting Hb-Oxygen Binding.</li> <li>Discuss sickle cell anemia.</li> <li>Discuss various types of hemoglobinopathies.</li> </ul>	5	Tests to detect proteins / peptides / amino acids
	<ul style="list-style-type: none"> <li>UQs Discussion</li> </ul>	1	

TOPIC	SUBTOPIC	LEARNING OBJECTIVES	LECTURE	SGD	PRACTICAL
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ENZYMES	<b>Intro</b>	<ul style="list-style-type: none"> <li>Define enzyme and substrate</li> <li>Discuss the biomedical importance of enzymes</li> <li>Identify the nature and structure of enzymes.</li> <li>Classify enzymes.</li> </ul>	<b>1</b>	<b>1</b>	Qualitative analysis of lipids
	<b>MOA</b>	<ul style="list-style-type: none"> <li>Discuss the mechanism of action of enzymes.</li> </ul>	<b>1</b>		
	<b>Enzyme action</b>	<ul style="list-style-type: none"> <li>Discuss the properties of enzymes.</li> <li>Discuss Michealis –Menten Equation.</li> <li>Identify the factors effecting enzymes action</li> </ul>	<b>1</b>		
	<b>Regulation</b>	<ul style="list-style-type: none"> <li>Discuss Line- Weaver Burke Plot.</li> <li>Explain effect of inhibitors on enzyme action.</li> <li>Discuss regulation of enzymes.</li> <li></li> </ul>	<b>1</b>		
	<b>Isoenzymes</b>	<ul style="list-style-type: none"> <li>Discuss regulation of enzymes.</li> <li>Define iso enzymes.</li> <li>Discuss the clinical significance of iso enzymes.</li> <li>Identify the therapeutic uses of enzymes.</li> <li></li> </ul>	<b>1</b>	<b>1</b>	Qualitative analysis of lipids
VITAMINS	<b>Introduction</b>	<ul style="list-style-type: none"> <li>Give definition, classification and requirement for humans of various vitamins.</li> <li>Enlist factors affecting the vitamin content of food.</li> </ul>	<b>1</b>		
	<b>Water soluble vitamins</b>	<ul style="list-style-type: none"> <li>Discuss important dietary sources, RDA, intestinal absorption, transport, storage and diseases associated with water soluble vitamins</li> </ul>	<b>5</b>	<b>1</b>	Physical & chemical analysis of urine to detect normal constituents.
	<b>Fat soluble vitamins</b>	<ul style="list-style-type: none"> <li>Discuss important dietary sources, RDA, intestinal absorption, transport, storage and diseases associated with fat soluble vitamins.</li> </ul>	<b>5</b>	<b>1</b>	Physical and chemical analysis of urine to detect normal constituents.

<b>MINERALS</b>	<b>Macro minerals</b>	<ul style="list-style-type: none"> <li>• Give introduction to minerals and trace elements.</li> </ul>	<b>1</b>	<b>1</b>	Collection and storage of urine samples for laboratory analysis, and physical and chemical analysis of urine to detect abnormal constituents.	
		<ul style="list-style-type: none"> <li>• Discuss Calcium and phosphorus metabolism.</li> <li>• Discuss Wilson disease, tetany, hypercalcemia.</li> </ul>	<b>2</b>			
		<ul style="list-style-type: none"> <li>• Discuss Phosphorus, magnesium and sulfur.</li> </ul>	<b>1</b>			
		<b>Electrolyte</b>	<ul style="list-style-type: none"> <li>• Discuss Sodium, potassium and chloride.</li> </ul>	<b>3</b>	<b>1</b>	Collection and storage of urine samples for laboratory analysis, and physical and chemical analysis of urine to detect abnormal constituents.
		<b>Microminerals</b>	<ul style="list-style-type: none"> <li>• Discuss Iron metabolism.</li> <li>• Describe Iron deficiency anemia, hemochromatosis,</li> </ul>	<b>2</b>		
			<ul style="list-style-type: none"> <li>• Discuss Iodine and copper.</li> <li>• Describe muscle weakness, neurologic defects and abnormal collagen in copper deficiency.</li> <li>• Highlight Iodine deficiency and goiter.</li> <li>•</li> </ul>	<b>2</b>		Collection and storage of urine samples for laboratory analysis, and physical and chemical analysis of urine to detect abnormal constituents
		<ul style="list-style-type: none"> <li>• Discuss Zinc, selenium, chromium, cadmium, manganese, and fluoride.</li> <li>• Discuss Cardiomyopathy (Keshan disease) in selenium deficiency.</li> <li>• Identify growth retardation and impaired wound healing in Zinc deficiency</li> </ul>	<b>1</b>	<b>1</b>		
	<b>NUTRITION</b>	<ul style="list-style-type: none"> <li>• Discuss balanced diet.</li> <li>• Define dietary reference intakes, acceptable macronutrient distribution ranges, EAR, RDA, AI and UL.</li> </ul>	<b>2</b>			
		<ul style="list-style-type: none"> <li>• Discuss energy metabolism</li> </ul>	<b>2</b>	<b>1</b>	Writing a urine report	

	<ul style="list-style-type: none"> <li>Define and discuss metabolic rate , factors affecting metabolic rate and basal metabolic rate BMR.</li> <li>Calculate caloric requirement of a person.</li> </ul>			and interpretation of urine analysis
	<ul style="list-style-type: none"> <li>Explain biomedical significance of proteins in nutrition.</li> </ul>	1	1	REVISION
	<ul style="list-style-type: none"> <li>Identify biomedical significance of lipids in nutrition.</li> </ul>	1		
	<ul style="list-style-type: none"> <li>Discuss biomedical significance of carbohydrates in nutrition.</li> </ul>	1		
	<ul style="list-style-type: none"> <li>Enlist the nutritional requirements in pregnancy, lactation, infancy and old age.</li> </ul>	1	1	REVISION.
	<ul style="list-style-type: none"> <li>Explain obesity and metabolic syndrome.</li> </ul>	1		
<b>Clinical correlations</b>	<ul style="list-style-type: none"> <li>Discuss Protein energy malnutrition (Marasmus and Kwashiorkor).</li> <li>Describe the effects of deficiency of essential fatty acids, anorexia nervosa and bulimia nervosa.</li> <li>Explain how hemorrhoids, chronic constipation and diverticular disease of colon is caused due to low fiber diet.</li> </ul>	3		

## TEXTBOOKS AND REFERENCES

1. Champe, P.C. & Harvey, E.A. (2017). Biochemistry (Lippincott's Illustrated Reviews), 7<sup>nd</sup> edition. J.B Lippincort Co.
2. Harper's Biochemistry – 30th Ed

3. Textbook of medical Biochemistry by MN Chatterjea – 8th Ed
4. Biochemistry by Stryer – 7th Ed
5. Marks, D.B., Marks, A.D. & Smith, C.M. (2005). Basic Medical Biochemistry: A Clinical Approach. 2<sup>nd</sup> edition. Williams and Wilkins Co.: Baltimore.
6. Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell. (2005). Harper's Biochemistry. 26<sup>th</sup> edition. McGraw-Hill

## **TABLE OF SPECIFICATIONS FOR BIOCHEMISTRY**

### **THEORY PAPER FIRST PROFESSIONAL**

CONTENTS		SEQs	MCQs
<b>1.</b>	Biochemistry of the cell, cell membrane & membrane phenomena. Water, pH & buffers.	0.5	3
<b>2.</b>	Extracellular matrix	0.5	2

3.	Chemistry of Carbohydrates	1.0	4
4.	Chemistry of Lipids	1.0	5
5.	Chemistry of Proteins and Amino Acids; Plasma proteins including immunoglobulins	1.0	6
6.	Chemistry of Nucleotide and nucleic acids	0.5	3
7.	Enzymes	1.0	5
8.	Vitamins	1.5	7
9.	Nutrition	0.5	2
10.	Minerals & trace elements	0.5	4
11.	Heme metabolism, porphyrins, porphyrias, jaundice, hemoglobin & Myoglobin, hemoglobinopathies.	1.0	4
TOTAL ITEMS		<b>09 SEQs</b>	<b>45 MCQs</b>
TOTAL MARKS		<b>45 Marks</b>	<b>45 Marks</b>

*25% of MCQs and SEQs should be clinically oriented or problem- based.*

*10% marks are allocated for 'Internal Assessment'*

**Total marks for theory paper: SEQ+ MCQ + Internal Assessment = 45 +45+10=100 Marks**

## **ORAL AND PRACTICAL EXAMINATION FIRST PROFESSIONAL**

Oral and practical examination carries 100 marks.

EXAMINATION COMPONENT		MARKS
<b>A</b>	<b>Internal Assessment</b>	10
<b>B</b>	<b>Practical notebook manual (Internal Examiner)</b>	05
<b>C</b>	<b>Viva voce</b> a) External Examiner: 25 Marks b) Internal Examiner: 25 Marks	50
<b>D</b>	<b>OSPE</b> a) Observed stations (6 Marks) b) Non-Observed Station (16 Marks)	22
<b>E</b>	<b>Practical</b> a) Principle & supposed calculation: 4 Marks b) Performance: 4 Marks c) Structured Table viva (External Examiner): 5 Marks	13