NUMS
NATIONAL UNIVERSITY
OF MEDICAL SCIENCES

MBBS
Year-I
2022

STUDY GUIDE

INDEX

1. Vision/mission
2. Introduction and Guidelines
3. Curriculum Map
4. Blockwise Learning Objectives
5. Table of Specifications
6. Sample MCQS and SEQS
7. Faculty list
8. Department library

1.VISION/MISSION STATEMENTS

Vision statement:

To ensure the development and sustenance of internationally acclaimed quality standards and practices for NUMS Higher Education that benefits and lives up to the stakeholders as needs and expectations.

Mission statement:

To provide an excellent learning and teaching environment, inculcating ethical values and social responsibilities in under-graduate and post-graduate medical and dental students and nursing and allied health sciences students to enhance the level of comprehensive health care in the Army/Country.

2.GUIDELINES AND INTRODUCTION

Department of Biochemistry

Introduction:

a. Preamble

Integration has been accepted as an important educational strategy in medical education. NUMS believes in continuous curriculum revision through regular reviews and feedback of stakeholders. This curriculum is updated as per recently revised standards of Pakistan Medical Commission (PMC) which sets Correlation as a minimum level of integration in MBBS. This curriculum is outcome based, patient centered, community relevant, promotes health and prevents disease. It has been revised by the faculty of basic and clinical sciences from constituent/affiliated colleges in collaboration with NUMS Academic Directorate and NUMS department of Health Professions Education.

b. Curricular organization and structure

1) NUMS MBBS curriculum will be delivered in a System Based Modular Format in the first three years and through clinical rotations/clerkships in years IV & V.
2) System based modules will link basic science knowledge to clinical problems. Students will be taught in an integrated manner so that subjects shall be presented as a meaningful whole. Students will have better understanding of basic sciences when they repeatedly learn in relation to clinical examples.
3) There will be three blocks, each will have modules, duration of which depends upon the number and complexity of the objectives to be achieved in that module.
4) The curriculum will be delivered by modular teams of multidisciplinary basic science faculty and relevant clinical faculty. The planning and delivery will be coordinated by year coordinators who will guide module coordinators of their respective years for efficient implementation
5) The syllabus will be integrated horizontally around systems of the body in which Anatomy, Physiology and Biochemistry will be taught with clinical relevance. Additional chunks of content will be added in a module that exactly does not fit in the central theme of the module.
6) Longitudinal themes (Behavioral Sciences and Research Methodology & EBM) are an integral part of year I & II
7) Islamiat and Pakistan Studies are compulsory subjects taught throughout the year in first and second year respectively
8) Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives
9) Professional Exams are discipline based. In first Prof, Anatomy, Physiology and Biochemistry and in second prof, Anatomy, Physiology, Biochemistry and Islamiat/Pakistan Studies will be assessed

c. Curriculum perspective

NUMS curriculum is evolved taking into consideration Constructivist and behaviorist with some element of Cognitivist approach. It allows students to construct their own knowledge based on what they already know and to use that knowledge in purposeful activities requiring decision making, problem solving, and judgments.

d. Level of integration: Correlation i.e level 7 of Harden's level of Integration. The emphasis remains on disciplines or subjects with subject-based courses taking up most of the curriculum

Blocks	BLOCK-I 13 +1= 14 weeks	BLOCK-II 9+1= 10weeks	BLOCK-III 9+1= 10 weeks

time. Within this framework, an integrated teaching session or course is introduced in addition to the subject-based teaching. This session brings together areas of interest common to each of the subjects. Though the teaching is discipline based, topics are correlated and taught with clinical context for better understanding and application of concepts.

e. Competencies. The focus of this curriculum is on the roles of a general physician as identified by PMC. These are skillful, knowledgeable, community health promoter, critical thinker, professional and role model, researcher and leader. Competencies focused in year I and II are: -

1) Medical Knowledge
2) Procedural skills
3) Problem solving
4) Communication skills
5) Professionalism
6) Research

f. Outcomes

By the end of years I & II, students should be able to:

1) Correlate the developmental and anatomical knowledge of different organ systems of human body to their physiological and biochemical basis.

2) Comprehend the significance of behavioural sciences for medical students

3) Analyze multiple perspectives of Islamic studies or ethics and Pakistan studies

4) Discuss the basic principles of research

g. Academic calendar Year I

Duration	02 weeks	02 weeks	06 weeks	03 Weeks	1 wk	9 weeks	1 wk	04 Weeks	05 Weeks	1 wk
Modules	Foundation I	Cell Structure & Function	MSK – I	Haem & Immunology	EOB	Cardiovascular System	EOB	Respiratory system	MSK – II	EOB
Disciplines	Anatomy, Physiology, Biochemistry, relevant clinical disciplines									
Across the year	Behavioral Sciences, Research Methodology and Islamiat									

h. Proposed Contact Hours Distribution Year-I

SUBJECTS	FIRST YEAR
Anatomy • Embryology • Histology • Gross Anatomy • General Anatomy	250
Physiology	225
Biochemistry	150
Medicine & Allied	30
Surgery & Allied	30
Behavioral Sciences	30
Research Methodology	10
Islamiyat	25
Self-Directed Learning	100
Co-curricular activities	50
TOTAL HOURS	**900**

i. Educational Strategies (These are proposed, but institutes can use other evidence-based teaching methodologies that suit their context)

1) Interactive Lectures
2) Small group discussion
3) Lab practical
4) Skill lab
5) Problem based learning/ Case based learning
6) Tutorials
7) Integrated sessions using any of the above strategies
8) Self-directed learning (SDL) and directed self-learning (DSL)

j. Resources. To be filled in by the institute

a. Faculty
b. Facilities
c. Administration for Course
d. Administrative structure
e. Communication with students

k. Internal Assessment

Formative assessment (low stake) is at faculty discretion like mid module test and other class tests. There will be three end of blocks and and one pre-annual examination in year I, which contributes towards the weighting of internal assessment i.e 20% in first professional MBBS Examination.

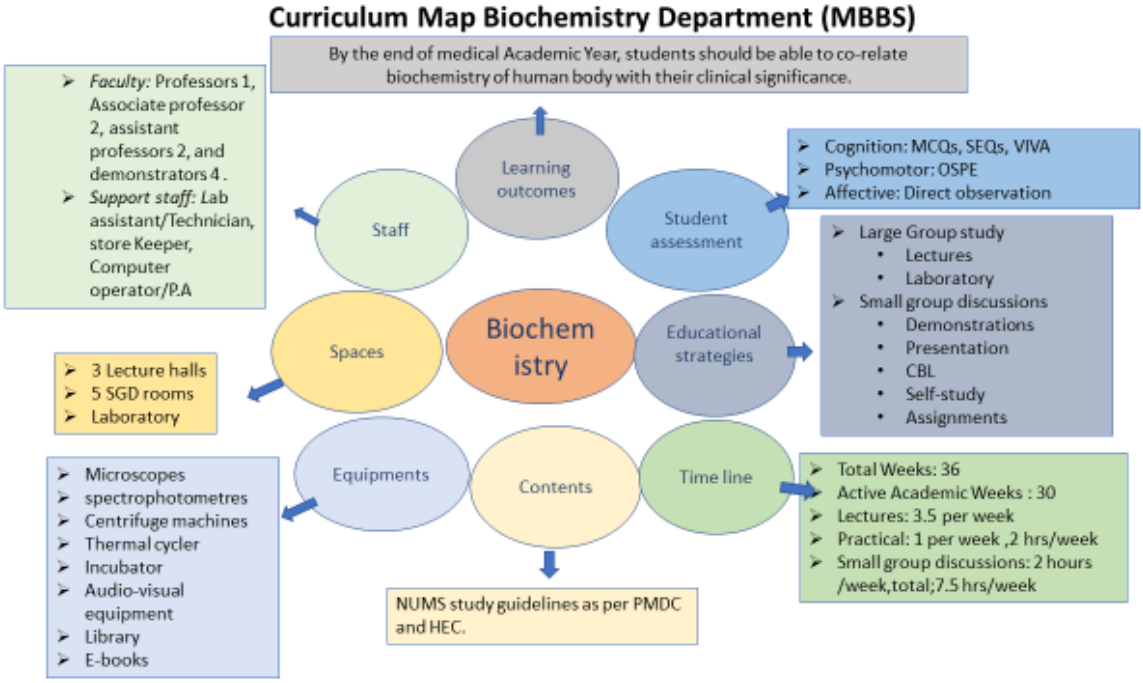
l. **Annual Professional Examination**.
The University will take the first professional Examination as per PMC guidelines at the end of the academic year. Annual Theory & Practical Examination will be of 200 marks for Anatomy, Physiology and Biochemistry. The passing score is 50% in theory and practical separately

m. **Evaluation of the Course.** To be filled in by the institute.
   a. Student portfolio shall be maintained in the departments in which students will give their feedback either by name or anonymously. Feedback may be taken at the end of module, online and informal student feedback during the running module
   b. Faculty suggestions if any, for improvement of training may be incorporated in the next rotation

n. **Implementation of curriculum**
*The university will give details of all content including learning outcomes, assessment blueprints, and table of specifications, distribution of which across the whole years and rotations is upon the discretion of the medical college/institute

3.CURRICULUM MAP

CURRICULUM MAP OF BIOCHEMISTRY DEPARTMENT



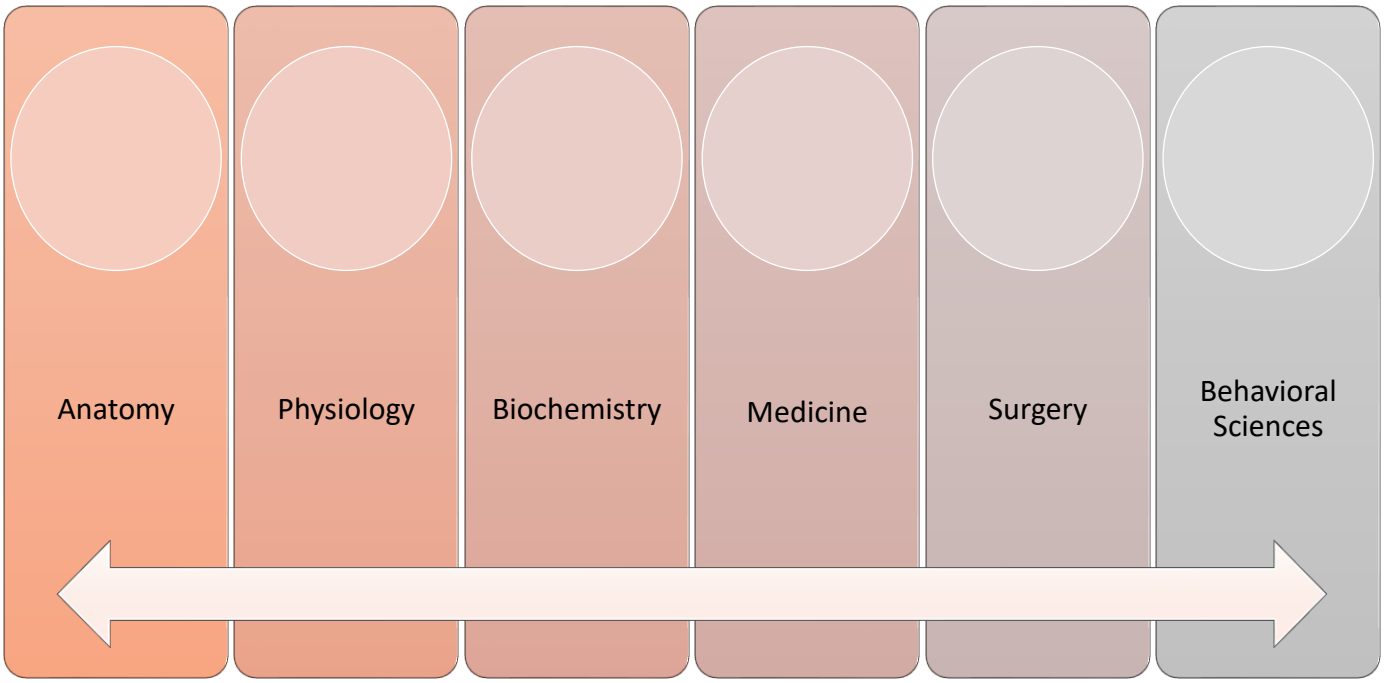
BLOCK-I MODULES

MODULE NO.	MODULE TOPICS
1.	Foundation module
2.	Cell Structure and Function
3.	Musculoskeletal System I (Minerals)
4.	Heme & Immunology

BLOCK I

MODULE 1: Foundation Module (2 weeks)

Integration of Disciplines in Foundation Module



Preamble

This module focuses on orientation of students to different disciplines to be taught in years I & II along with their grooming through basic themes of Behavioral Sciences. It includes basic anatomical, physiological and biochemical concepts about the human body and its development. Students will also be introduced to clinical subjects. Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives

General Learning outcomes:

By the end of this module the students will be able to recognize the role of different disciplines in studying human body and its diseases.

S.No	Learning outcomes	Discipline
1.	Comprehend the basic concepts of biochemistry	Biochemistry

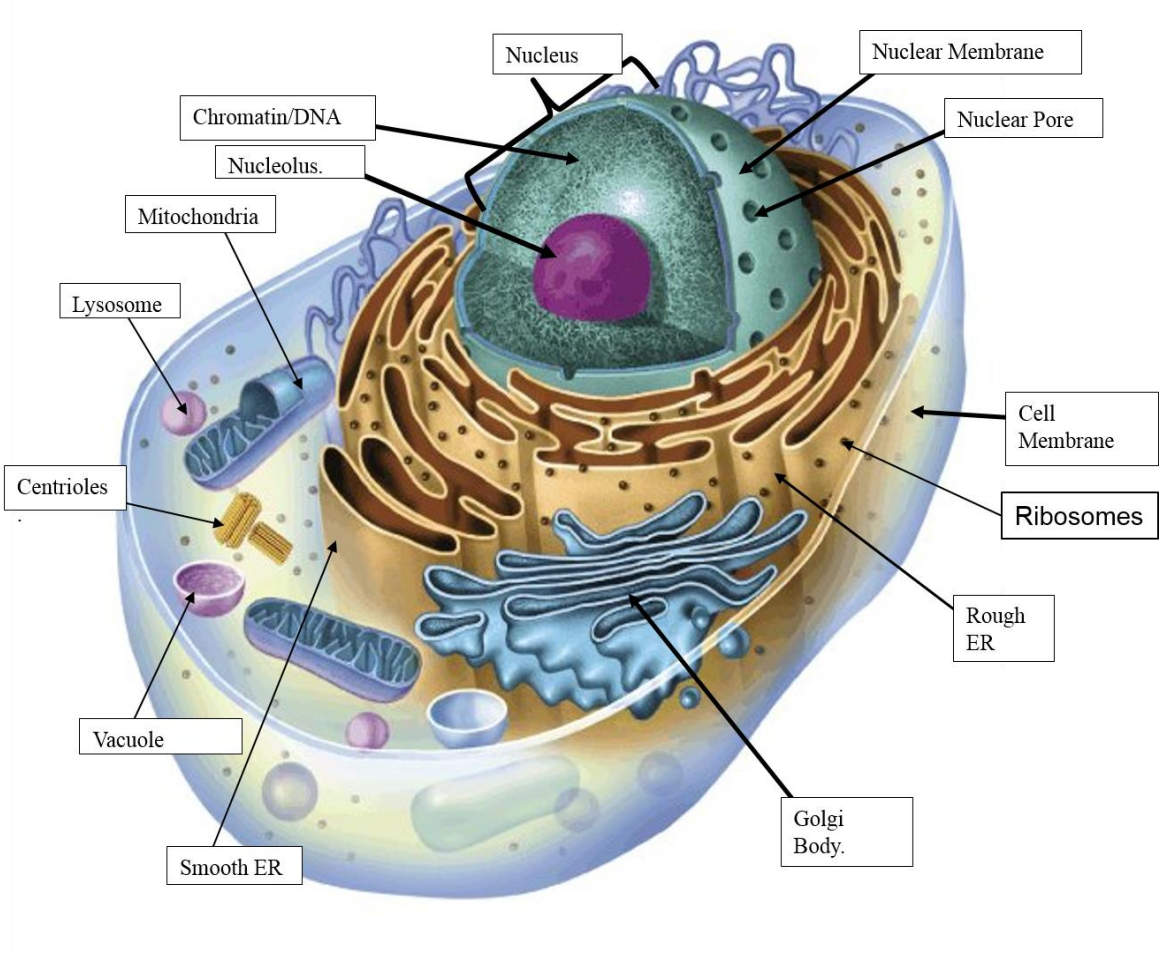
Course Outline

BIOCHEMISTRY

1	**Introduction**	Comprehend the basic concepts of biochemistry		Lecture	Formative

BLOCK I

MODULE 2: Cell Structure and Function (2 weeks)



Preamble

This module introduces the student to the basic structure and functioning of the cell and molecules and how dysfunctions in cell can lead to disease. The research methodology, Behavioral Sciences and Islamiat will be taught as a part of the longitudinal theme. Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives

Learning Outcomes

At the end of this module, student will be able to:

- Relate the embryological, histomorphological knowledge of cell to its physiological and biochemical basis
- Appraise the clinical aspect related to dysfunctions in the cell

Topic/ Theme	Learning outcomes	Disciplines
Cell structure & Functions	• List various Biomolecules • Differentiate between Cell Organelles, their structure, biochemical functions and associated disorders • List various Cytology techniques for study of a cell • Discuss the chemical composition of a cell membrane and its significance regarding a particular cellular environment. • Relate the concept of chemistry and role of signal transduction in health and disease	**Biochemistry**

List of Proposed Themes for integrated sessions (at least one/week)

Theme
Cell
Development of human body

YEAR I					
BLOCK I					
S.No	**Topic/ Theme**	**Learning outcomes**	**Learning Objectives/Contents**	**Instructional strategies**	**Assessment tool**
1.	**Cell**	List various Biomolecules	• Explain Cell Biochemistry • Elaborate various Biomolecules	• Lectures • SGD	• MCQ • SAQ/SEQ • Structured viva
		Differentiate between Cell Organelles, their structure, biochemical functions and associated disorders	• Enumerate and describe various Cell Organelles in detail (Nucleus, Mitochondria, Ribosomes, Golgi Apparatus, Endoplasmic Reticulum, Lysosomes and Peroxisomes) • Elaborate genetic control of cellular functions with help of a diagram • Outline the role of various cell Organelles in various cellular metabolisms		
		List various Cytology techniques for study of a cell	• Comprehend various Cytology techniques for study of a cell		
		Discuss the chemical composition of a cell membrane and its significance regarding a particular cellular environment	• Draw and explain the chemical composition of a cell membrane describe its significance regarding a particular cellular environment		
		Relate the concept of chemistry and role of signal transduction in health and disease	• Describe the chemistry of cell signaling mechanism and enlist the various		

			receptors involved in it accordingly • Elaborate the role of signal transduction in health and disease • Describe various membrane transport mechanisms • Tabulate various types of transports across the cell membrane i.e. active transport, passive transport, simple diffusion and facilitated diffusion with one example		
	Practicals		• Introduction to use of laboratory glassware • Introduction to use of laboratory equipment ➢ Spectronic 20, microlab, incubator, water bath, hot oven, centrifuge, electronic balance • Preservation and collection of clinical specimen	•	•

BLOCK I

MODULE 3: Musculoskeletal System (6 weeks)

(Minerals)

Preamble

The Musculoskeletal system is responsible for locomotion, support and protection to the human body. This system consists of osteology (the study of bones), arthrology (the study of joints), and myology (the study of muscles) of upper limb. It also includes basic structure and functioning of the nerve and muscles and how their dysfunctions can lead to disease. Along with this, biochemical aspect of mineral and trace elements is also a part of this module. The research methodology, Behavioral Sciences and Islamiat will be taught as a part of the longitudinal theme

Learning Outcomes:

At the end of this module, student will be able to:

- Correlate the anatomical knowledge of upper limb with common clinical presentations.
- Apply the physiological knowledge of nerve and muscles to understand various neuromuscular diseases.
- Relate the biochemical importance of mineral & trace element for understanding their related disorders

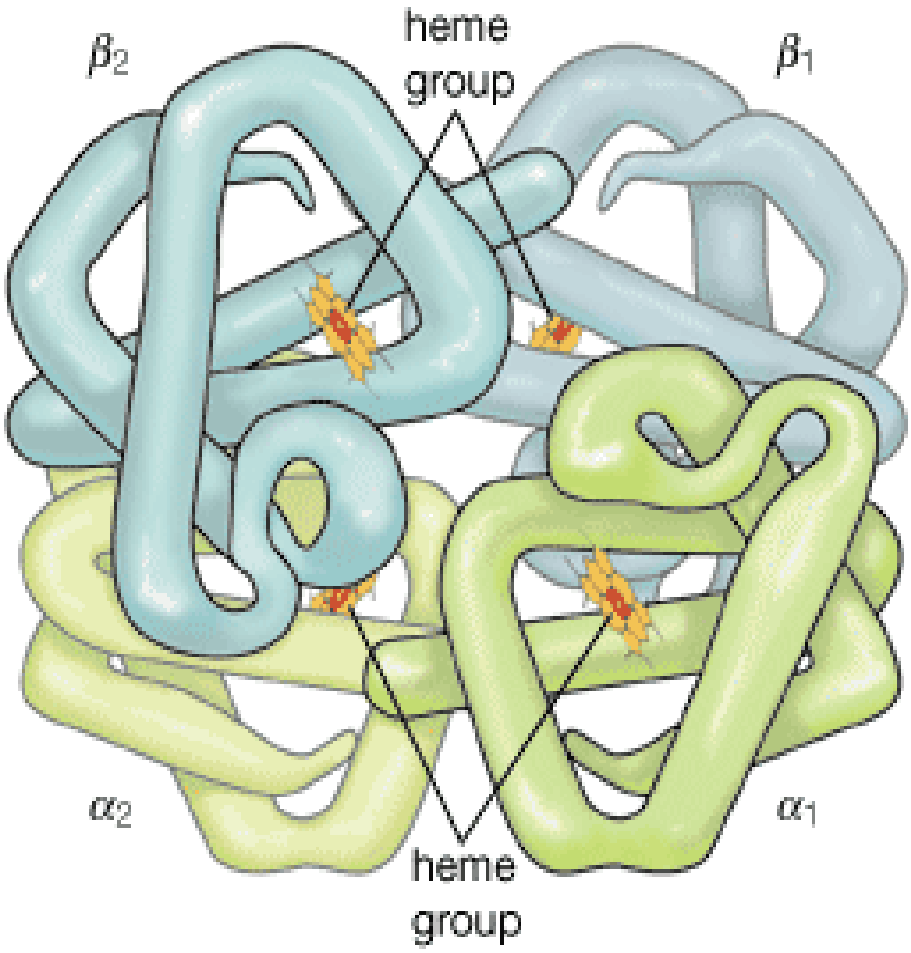
Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives

TOPICS	*OUTCOMES*	Disciplines
	By the end of this module, student should be able to:	
Mineral & Trace Elements	Apply the basic knowledge of minerals for understanding their related disorders	**Biochemistry**

BIOCHEMISTRY					
S.No	**Topic/ Theme**	**Learning outcomes**	**Learning Objectives/Contents**	**Instructional strategies**	**Assessment tool**
1.	**Mineral & Trace Elements**	Apply the basic knowledge of minerals for understanding their related disorders	➢ Classify minerals ➢ Write down the sources, biochemical role and related diseases of Macro minerals (Na, K, Ca, Cl, PO_4) in human body ➢ Write down the sources, biochemical role and related diseases of Micro minerals (Fe, Zn, Mg, Se, I, Cu, Cr, Cd, Mn)	• Lectures • SGD	MCQ/ SAQ/SEQ
	Practicals		➢ Flame photometry and estimation of electrolytes		

BLOCK I

MODULE 4: Heme & Immunology (3 weeks)



Preamble

This module introduces the student to the connective tissue, cartilage and bones with their function along with physiological imbalances occurring due to deficiencies in contents, functions & features of blood. Biochemical importance of plasma proteins and haemoglobin for understanding its related disorders is also taught in this module. The research methodology, Behavioral Sciences & Professionalism will be taught as a part of the longitudinal theme.

Learning Outcomes:

At the end of this module, student will be able to:

- Correlate the microstructure of different lymphoid organs with their function and to comprehend the outcomes that result from altered structure.
- Appraise the embryological basis of common congenital anomalies related with trilaminar germ disc.
- Appraise any physiological imbalances occurring due to deficiencies in contents, functions & features of blood
- Apply the understanding of plasma proteins and haemoglobin to its related disorders

Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives

TOPICS	***OUTCOMES***	**Disciplines**
	By the end of this module, student should be able to:	
Porphyrin and Hemoglobin	Correlate the biochemical basis of Porphyrin and Hemoglobin with clinical conditions	**Biochemistry**
Plasma proteins and Immunoglobulins	Relate the basic knowledge of Plasma proteins to its clinical significance	

List of Proposed Themes for PBL sessions (at least one/week)

Theme
Pallor
Enlarged lymph nodes
Splenomegaly
Transfusion reactions

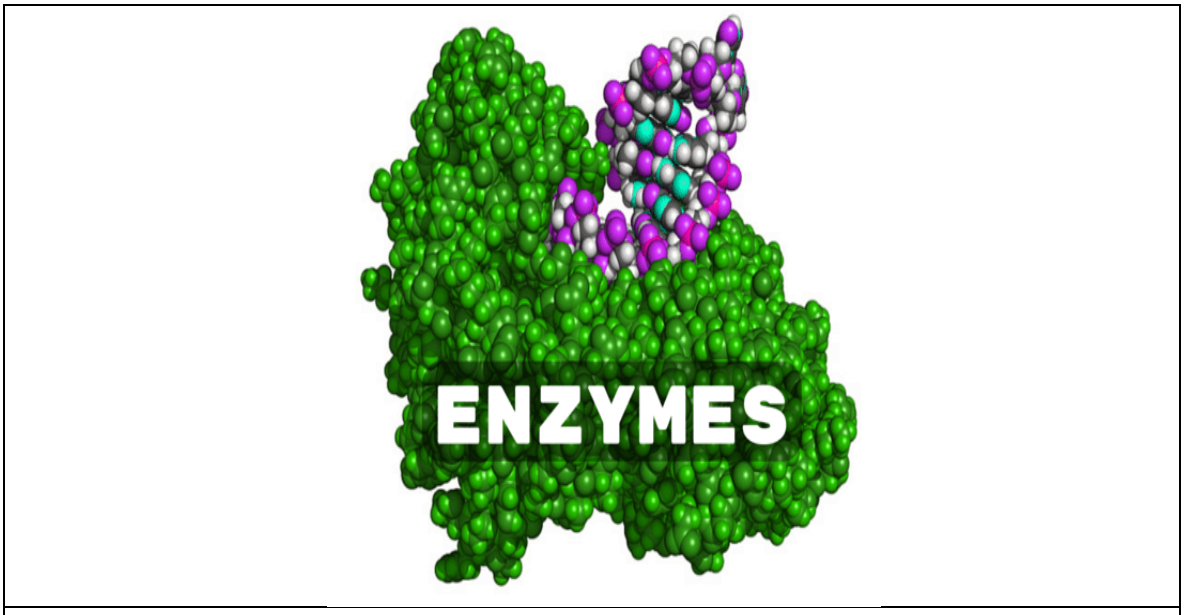
Sr	TOPIC/THEME	Learning Outcomes	Learning Objectives/Contents	Instructional strategies	Assessment tool
1.	**Porphyrin and Hemoglobin**	Correlate the biochemical basis of Porphyrin and Hemoglobin with clinical conditions	• Enumerate various types of Hemoglobin and explain its functions in detail • Discuss the Oxygen binding capacity of hemoglobin with reference to the O_2-Hb dissociation curve • Enlist various Factors affecting and regulating the oxygen binding capacity of haemoglobin • Give a brief account of Chemistry and biosynthesis of Porphyrins and its disorders (Porphyrias) • Explain Degradation of heme, formation of bile pigments, their types, transport and excretion • Discuss Hyperbilirubine mia and jaundice • Explain various Hemoglobinopat hies (Hb-S,Hb-C, Hb-SC, Methemoglobin opathies and	• Lectures • SGD	

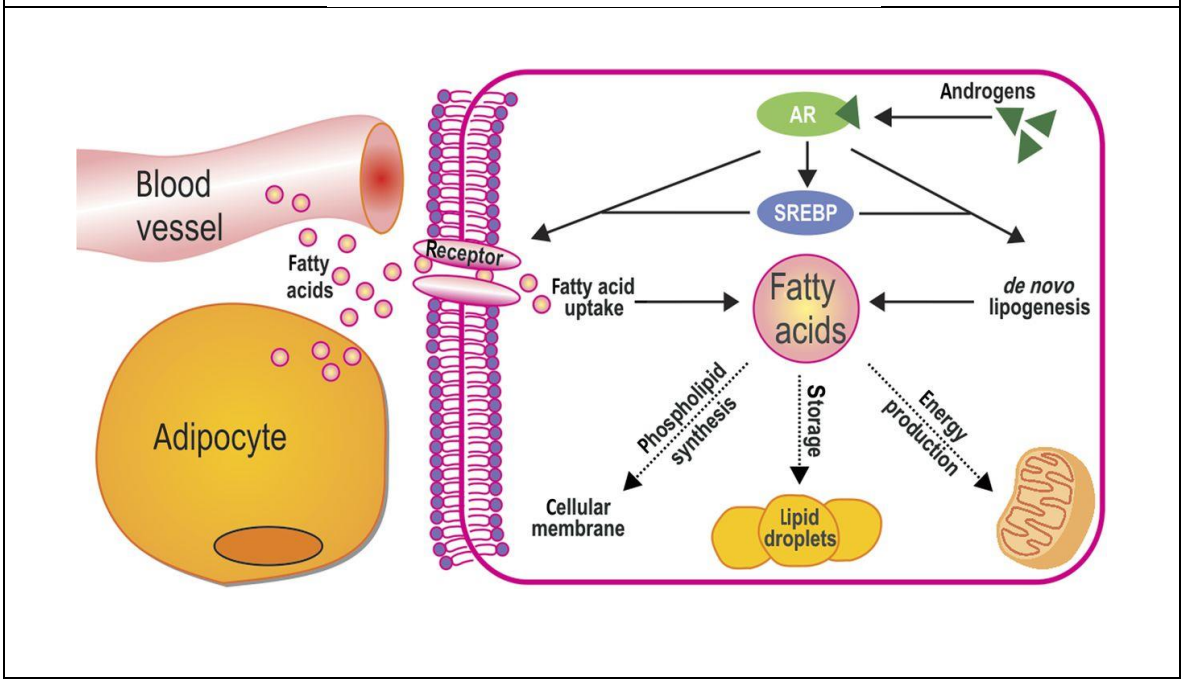
			thalassemia) and elaborate their biochemical causes		
2.	**Plasma proteins and Immunoglobulins**	Relate the basic knowledge of Plasma proteins to its clinical significance	➢ Define Plasma proteins & give their clinical significance ➢ Draw and label the Structure of Immunoglobulins ➢ Enumerate major types, functions & Properties of Immunoglobulin	• Lectures • SGD	OSPE
	Practicals	Interpret the results	➢ Physical examination of urine ➢ Chemical examination of urine-Ehrlich's test ➢ Estimation & clinical interpretation of plasma proteins ➢ Estimation & clinical interpretation of Bilirubin		

BLOCK II

MODULE 5: Cardiovascular System (9 weeks)

(Enzymes, Lipid Chemistry, Lipid Metabolism)





Preamble

This block focuses on cardiovascular system with basic understanding of structure of thorax. At the very outset medical student should understand that cardiovascular system has fundamental importance in all the fields of Medicine. Coronary artery diseases alone are one of the leading causes of morbidity and mortality worldwide. The course of this block is designed for first year MBBS students in an integrated manner.

Learning Outcomes:

At the end of this module, student will be able to:

- Correlate the gross anatomical, developmental & light microscopic features of cardiovascular system with their functions to apply this knowledge in relevant clinical scenarios encountered in subsequent years of training and practice.
- Apply the knowledge of Gross Anatomy of thorax in appraising the anatomical basis of relevant clinical scenarios.
- Correlate the developmental events during the embryonic and fetal periods, placental formation and multiple pregnancies with embryological basis of relevant clinical conditions.
- Analyze basic principles of cardiovascular physiology, interplay of various components of the vascular system and experimental aspects of Cardiovascular Physiology
- Relate the understanding of biochemical basis of lipids to its clinical significance.

Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives

TOPICS	***OUTCOMES***	**Disciplines**
	By the end of this module, student should be able to:	
Enzymes	Elaborate the biochemical importance of enzymes, coenzymes, co-factors, and isoenzymes as well as their role in various clinical conditions	**Biochemistry**
Lipid Chemistry	Relate the significance of different lipids in medicine	**Biochemistry**
Lipid Metabolism	Apply the knowledge of lipid metabolism for understanding relevant metabolic disorder	
Practical	• Analyze the results of given experiment • Differentiate between types of lipids	

List of Proposed Themes for integrated sessions (at least one/week)

Theme
Chest pain
Dyspnoea
Changes in ECG
High blood pressure
Dyslipidaemia
Palpitations
Decreased heart rate

BIOCHEMISTRY					
S.NO	**Topic/ Theme**	**Learning Outcomes**	**Learning Objectives/Contents**	**Instructional Strategies**	**Assessment tools**
1.	**Enzyme**	Elaborate the biochemical importance of enzymes, coenzymes, co-factors, and isoenzymes as well as their role in various clinical conditions	• Define Enzymes and classify them on basis of their mechanism of actions • Explain coenzymes, co-factors, and isoenzymes with their biochemical importance • Write down the mechanism of catalysis of enzymes • Describe the factors affecting enzymes activity • Define Michaelis-Menten equation & Lineweaver-Burk plot and its application in enzyme kinetics (no derivation of equations) • Compare & contrast different types of enzyme inhibitions with examples & biomedical importance • Explain regulatory enzymes • Application of enzymes in clinical diagnostics and therapeutics (Describe the role of Troponins in diagnosis of MI)	• Lectures • SGD • CBL/PBL	• MCQ/ SAQ/SEQ

2	**Lipid Chemistry**	Relate the significance of different lipids in medicine	• Define lipids and enumerate their biomedical functions • Describe lipid classification with examples & biochemical significance also explain nutritional significance of lipids • Explain the structure, chemistry, classification and biochemical functions of Fatty acids along with their nutritional role • Describe Eicosanoids, their classification and functions in health and disease • Describe Steroids, Sterol e.g. Cholesterol, their chemistry, functions and clinical significance. Explain rancidity of fats, lipid peroxidation and its biochemical significance	Lecture/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

3	**Lipid Metabolism**	Apply the knowledge of lipid metabolism for understanding relevant metabolic disorders	• Describe in detail the biosynthesis of fatty acids, their regulation and related disorders • Explain the mobilization and Oxidation of fatty acids along with types of oxidation (beta, alpha, omega etc), bioenergetics, regulation and related disorders • Give oxidation of fatty acids with odd number of carbon atoms • Give a brief account of oxidation of Unsaturated fatty acids • Elaborate the phospholipid synthesis and degradation. Discuss related metabolic disorders • Explain Triacylglycerol synthesis with its regulation • Explain Mechanism of synthesis of ketone bodies and give their utilization and significance in body. Define Ketosis and explain its mechanism • Explain the mechanism of Cholesterol synthesis along with its regulation. Enumerate functions and fate of the intermediates of Cholesterol degradation. Differentiate	Lecture/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

			between Bile Acids and Bile Salts • Define and explain Hypercholesterolemia in relation with the pathophysiology of atherosclerosis • Discuss the metabolism of Plasma Lipoproteins (VLDL, LDL, HDL, and Chylomicrons) with respect to their transport, functions and importance in health and disease. Discuss apolipiproteins and their role in lipoprotein metabolism		

Practicals					
	Practical	• Analyze the results of given experiment • Differentiate between types of lipids • Study the various enzymes related to myocardial infarction	Rancidity of Fats Microscopic Examination of Cholesterol Crystals Salkowski's Test Liebermann Burchard Test Chemical Examination of Urine - Rothera's Nitropruside Test Estimation & clinical interpretation of serum cholesterol Lipid profile LDH CK Trop T	Practical	OSPE

BLOCK III

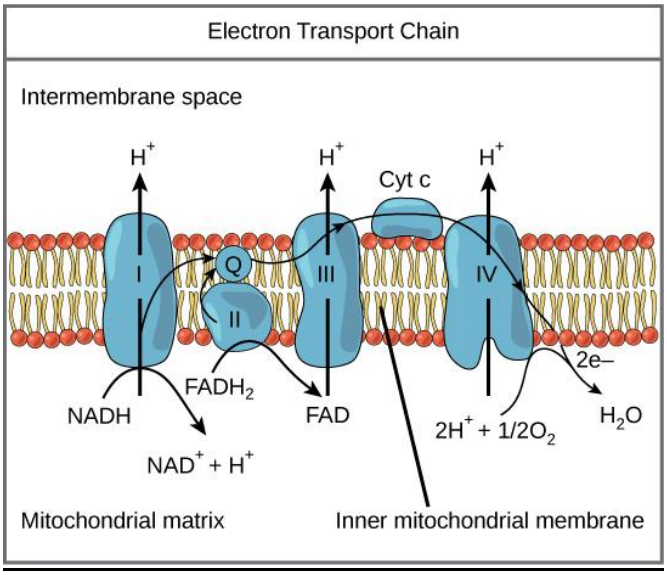
MODULE 6: Respiratory System (Bioenergetics and Biological Oxidation, Vitamins)

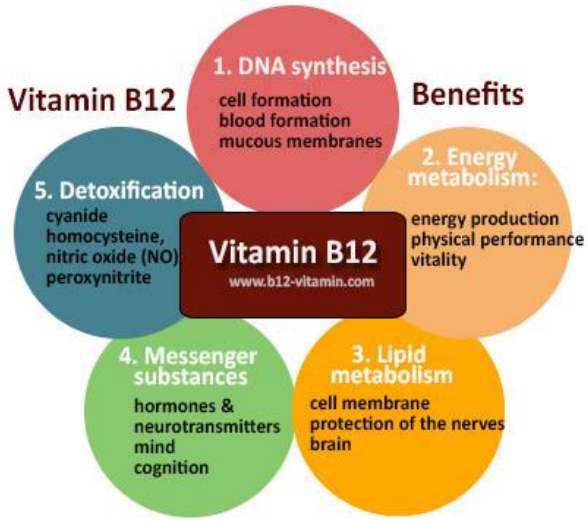
MODULE 7: Musculoskeletal System II (Protein Chemistry and Metabolism)

BLOCK III

MODULE 6: Respiratory System (4 weeks)

(Bioenergetics and Vitamins)





Preamble

One of the unfortunate gifts of industrialization is varied respiratory illnesses. However, high prevalence of chronic respiratory diseases, mortality and morbidity associated with it is a burden that is not limited to affluent countries. According to a lancet report, nearly 545 million of world population (7.4% of world's population) suffers from chronic respiratory condition. However, disability remains highest in our part of the world (South Asia), where premature mortality from chronic respiratory diseases is highest! Risk factors for men include air pollution, cigarette and sheesha smoking causing rise in COPD cases. Amongst women, exceptions exist, as household air pollution from solid fuels and ambient particulate matter are the were the leading cause. Genetics also play a part in diseases like asthma, sarcoidosis, interstitial lung diseases. However, certain lifestyle and behavioral modifications can overcome genetic and environmental factors improving the morbidity. Therefore, a firm

understanding of the respiratory system is very important for undergraduate students so that they can manage these diseases in clinical settings reducing disease burden in society.

This module focuses on respiratory system along with knowledge of Bioenergetics and Biological Oxidation and vitamin. Content of 'Gross Anatomy of thorax, development of body cavities and diaphragm" will be taught in block-II. However, revisit of thorax (lungs and respiratory movements) is included in this block for integration with physiology

The research methodology, Behavioral Sciences & Professionalism will be taught as a part of the longitudinal theme.

Learning Outcomes:

At the end of this module, student will be able to:

- Correlate the macro- and microscopic features of chest cage, chest cavity, and lungs with its functions and dysfunctions.
- Analyze physiological mechanisms and their regulations operating within respiratory system under varied atmospheric pressures.
- Interpret signs, symptoms, and investigations of respiratory and acid base disorders.
- Discuss cellular mechanisms involved in respiration

Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives

TOPICS	***OUTCOMES***	**Disciplines**
	By the end of this module, student should be able to:	
Bioenergetics and Biological Oxidation	• Justify the role of ATP and energy metabolism in health and disease	**Biochemistry**
Vitamins	• Classify vitamins. • Relate the knowledge of water soluble and fat soluble vitamins for understanding of its deficiency and excess manifestations	

List of Proposed Themes for integrated sessions (at least one/week)

Theme
Cough
Dyspnoea
Hemoptysis
Fever with cough

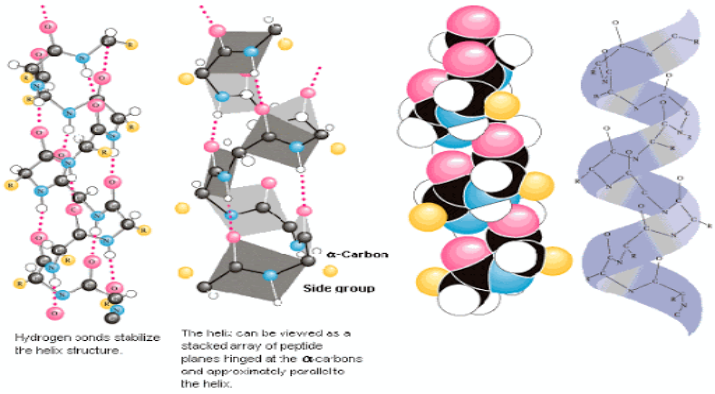
BIOCHEMISTRY –					
S.NO	**Topic/ Theme**	**Learning Outcomes**	**Learning Objectives/Contents**	**Instructional Strategies**	**Assessment tools**
1.	**Bioenergetics and Biological Oxidation**	Justify the role of ATP and energy metabolism in health and disease	• Discuss Free energy, Free energy change, standard energy change, Endergonic and exergonic reactions and ATP • Describe electron transport chain and its components, organization, reactions, energetics • Phosphorylation of ADP to ATP • Chemiosmotic hypothesis • Membrane transport systems • Inherited defects in OXPHOS • Mitochondria & apoptosis • Describe inhibitors of ETC and inhibitors/Uncouplers of oxidative phosphorylation	Lectures/ SGD CBLs	MCQ SAQ/SEQ
2.	**Vitamins**	• Classify vitamins • Relate the knowledge of water soluble and fat soluble vitamins for understanding of its deficiency and excess manifestations	• Classify various types of vitamins • Discuss chemistry, sources, biochemical functions, daily allowance, deficiency manifestations and toxicity of water soluble vitamins (Vitamin C & B complex) • Discuss chemistry, sources, biochemical	Lecture/ SGD/ CBL	MCQ/ SAQ/ SEQ

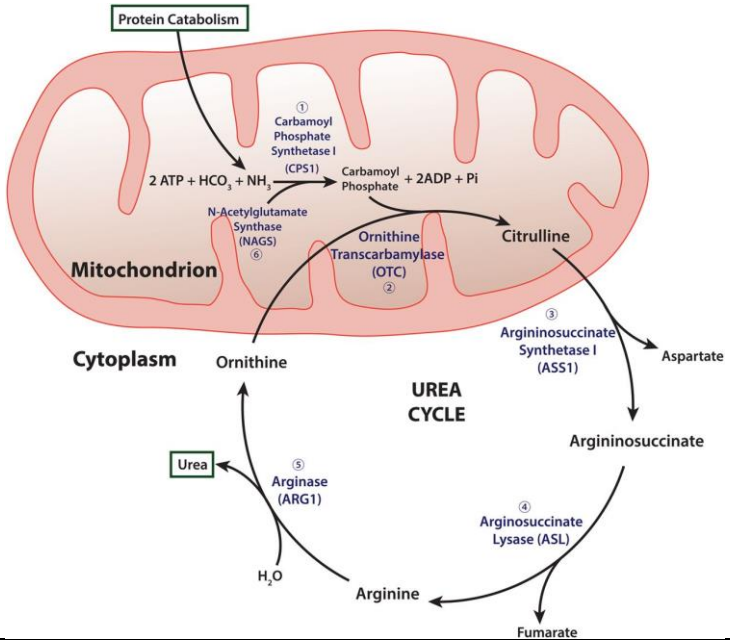
			functions, daily allowance, deficiency manifestations and hypervitaminosis of fat soluble vitamins (vitamin A, D, E & K)		
	Practicals	Interpret the results of given samples	Interpret the results of Vit C Vit D Vit A		

BLOCK III

MODULE 7: Musculoskeletal System II (5 weeks)

(Protein Chemistry and Metabolism)





Preamble

The locomotor system is responsible for locomotion, support and protection to the human body. This system consists of osteology (the study of bones), arthrology (the study of joints), and myology (the study of muscles) of lower limb

Learning Outcomes:

At the end of this module, student will be able to:

- Correlate the gross anatomy of bones, joints, muscles, and neurovascular bundle & joints of lower limb with clinical presentations of abnormal gait (e.g., fractures, sprains, dislocations, nerve injuries, gait disorders)
- Analyze the respiratory and cardiovascular adjustments in body during exercise, at high altitude, in deep sea and space
- Apply the knowledge of protein metabolism for understanding relevant metabolic disorders

Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives

TOPICS	***OUTCOMES***	**Disciplines**
	By the end of this module, student should be able to:	
Protein Chemistry	Relate the significance of different proteins in medicine	**Biochemistry**
Protein Metabolism	Apply the knowledge of protein metabolism for understanding relevant metabolic disorders	

List of Proposed Themes for integrated sessions (at least one/week)

Theme
Waddling Gait
Swollen knee joint
Foot drop
Numbness in leg

Protein

S.No	Topic/ Theme	Learning outcomes	Learning Objectives/Contents	Instructional strategies	Assessment tool
1.	**Protein Chemistry**	Relate the significance of different proteins in medicine	• Describe Proteins, Dipeptides, Tripeptides and polypeptides with examples • Structural organization of proteins and their Biochemical importance • Classify proteins (physicochemical, functional, structural, nutritional etc) • Define amino acids. Draw their structure and explain their various properties & functions • Classify amino acids and give their nutritional significance • Fibrous and globular proteins • Describe the dissociation & titration curve and importance of amino acids regarding pH maintenance in human body • Enlist various mechanisms of separation of proteins e.g. salting out, Electrophoresis, Chromatography and Centrifugation etc. Explain each in detail. ➢ Explain Folding & Misfolding of proteins along with associated diseases	• Lectures • SGD • CBL	• MCQ • SAQ/SEQ • Structured viva

2.	**Protein Metabolism**	Apply the knowledge of protein metabolism for understanding relevant metabolic disorders	➢ Amino acid pool, protein turnover and nitrogen balance ➢ Outline the mechanism of Nitrogen excretion from the human body • Define and exemplify various mechanisms of transamination, deamination, decarboxylation, deamidation, mechanism of Amino acid oxidation • Describe the transport of amino group, role of Pyridoxal phosphate, Glutamate, Glutamine, Alanine ➢ Draw Urea cycle and discuss its regulation in detail ➢ Describe Genetic defects of Urea cycle ➢ Explain in detail the concept of Ammonia intoxication ➢ Comprehend Carbon skeleton metabolism and its importance • Describe various metabolic fates of an amino acid ➢ Specialized products of amino acids (catecholamines, histamine, serotonin, creatine, melanin, melatonin etc) ➢ Describe Functions, pathways of amino acid degradation and genetic disorders of individual amino acids		
Practicals					

1.	**Qualitative analysis of Proteins**	Interpret the results of given experiments	Biuret Test Ninhydrin Test Xanthoproteic Test Millon's Test Aldehyde Test Sulphur Test	Practical	OSPE
2.	**Chemical examination of urine**		Sulfosalicylic acid test Heat coagulation test		
3.	**Estimation and interpretation of given sample**		• Estimation & clinical interpretation of serum urea • Estimation & clinical interpretation of serum creatinine		
4.	**Separation techniques**		Paper chromatography		

5. TABLE OF SPECIFICATIONS

First Professional MBBS Examination (2022)
Biochemistry

Time Allowed **=03 hrs** *(Including MCQs)*
Marks of theory paper **=80**
Internal assessment **=20**
Total marks **=100**
Pass Marks **= 50**
40 x MCQs **=40** **Time =50 min**

7x SAQ/SEQs (Recall) **= 04 marks each**

2x SAQ/SEQ(Application) = 06 marks each

Topic	NUMBER OF MCQs (40)		7 x SAQ/SEQs (Recall) 04 marks each	2 x SAQ/SEQs (Application) 06 marks each
	Recall	Application		
Chemistry of Protein & Amino Acids + Metabolism of Proteins and Amino Acids	06	02	01	02 x whole course
Chemistry of Lipids + Metabolism of Lipids	06	02	01	
Vitamins	04	02	01	
Mineral and Trace Elements	03	02	01	
Porphyrins & Hemoglobin	03	02	01	
Enzymes	03	02	01	
Biochemistry of cell & Biological membrane + Immunoglobulins	02	01	01	
	27	**13**	**07**	**02**
Total	**40 (40 Marks)**		**09 (40 Marks)**	

Theory: Internal Assessment (IA) Calculation (20 Marks)

Exams	Weightage	Exams	Percentage
End of Block Pre annual Exams	80%	End of Block Exam - I	20
		End of Block Exam - II	20
		End of Block Exam- III	20
		Pre-Annual Exam	20
Modular Exams/Class performance	20%	Modular Tests	10
		Assignments	10
Total	**100%**		**100%**

Table of Specifications for Annual Professional Exam: Practical

Viva (Theory) 40 marks		Practical/OSPE 40 marks				Total
Internal Examiner	External Examiner	OSPE (20)		Viva + Performance	Journal	
		Observed (2 Station)	Unobserved (10 Station)			
20	20	10	10	15	5	**80**

Practical: Internal Assessment Calculation (20 Marks)

Exams	Weightings	Exams	Percentage
End of Block Pre annual exam	80%	End of Block Practical/OSCE I	20
		End of Block Practical/OSCE II	20
		End of Block Practical/OSCE III	20
		Pre-Annual Exam	20
Class performance	20%	*SGD/ CBL/ PBL/practical	20
Total	**100%**		**100%**

*SGD = Small Group Discussion
CBL = Case Based Learning
PBL = Problem Based Learning

6.SAMPLE MCQS AND SEQS

Sample MCQs and SEQs

Multiple Choice Question (MCQs)

- A multiple-choice question (MCQ) consist of a stem that states the question or problem followed by a set of possible answers that contain an option that is best answer to the question.

- After reading the questions students should select the appropriate option from the given possible answers.

- The correct answer carries one mark and incorrect carries zero. There is no negative marking.

Sample MCQ

Starch and glycogen are polymers of:

A. Fructose

B. Mannose

C. beta D-glucose

D. alpha D-glucose

KEY: D

Short essay question (SEQs)

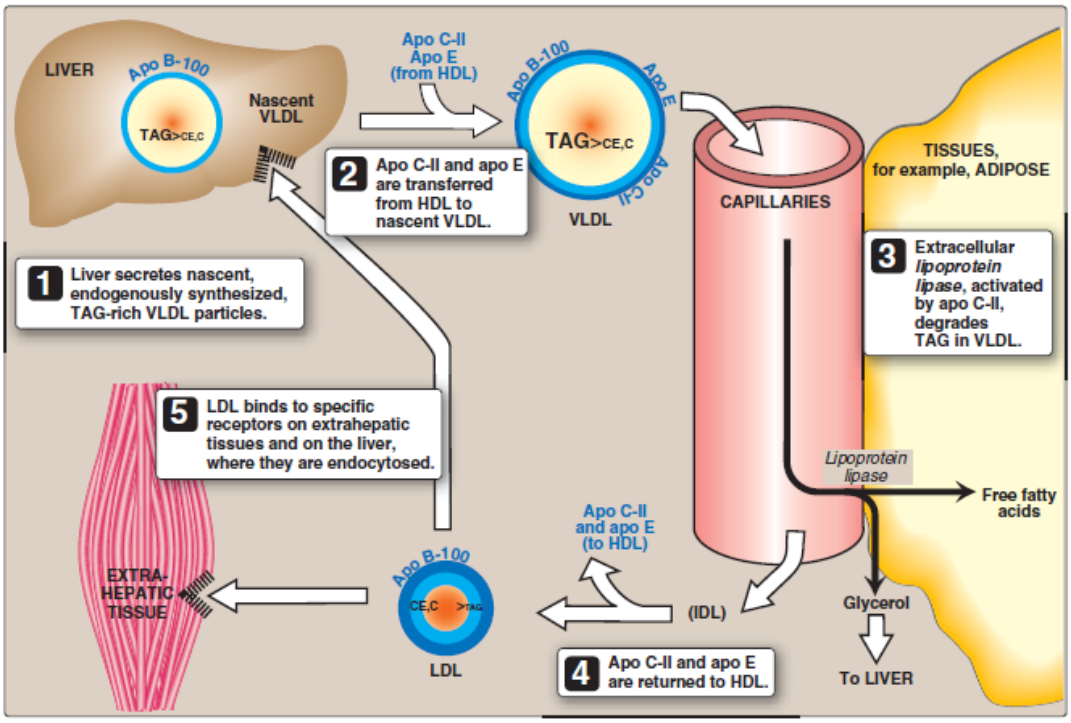
- Short essay questions require students to present written answers that are used to asses basic knowledge of key facts and provide students with an opportunity to demonstrate reasoning and explain their understanding of the subject.

Sample SEQ

A 60 year old diabetic and hypertensive female presents in the ER with sudden onset of crushing central chest pain radiating to left arm. Family history of heart disease is positive as well. Her ECG reveals ST segment elevation . Lab investigations revealed high levels of serum cholesterol and raised LDL and VLDL. She is diagnosed with type II hyperlipidemia.

a)Illustrate diagrammatically the metabolism and circulation of VLDL?
b) What is reverse cholesterol transport??

Key:
a)Illustrate diagrammatically the metabolism and circulation of VLDL ?



b) What is reverse cholesterol transport?

The selective transfer of cholesterol from peripheral cells to HDL, and from HDL to the liver.Reverse cholesterol transport involves efflux of cholesterol from peripheral cells to HDL, esterification of cholesterol by LCAT, binding of the cholesteryl ester–rich HDL (HDL2) to liver and steroidogenic cells, the selective transfer of the cholesteryl esters into these cells, and the release of lipid-depleted HDL (HDL3)

7.FACULTY LIST

MBBS Biochemistry Faculty Members

Name	CNIC No	PMDC Reg No	PMDC Faculty No	Designation	Qualification	Email Address
Dr. Iram Fayyaz	61101-1122012-4	16303-P	6036/16303-P/M	Professor & HOD	MBBS, MPhil, DCH (glassgow), CMT	iram_nadeem@yahoo.com
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MBBS Biochemistry Ancillary Staff Members

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Zia-Ur-Rehman	38402-7919654-3	DMLS	Laboratory Assistant
Naeem Khan	35202-3090119-3	Matric	Laboratory Assistant
Usman Ameen	35201-9334542-1	B.Com	Computer Operator
Hassan Rasool	35201-78105895	M.Sc.	Laboratory Attendant

8.DEPARTMENTAL LIBRARY

Departmental library	
1. Textbook of Medical Biochemistry (MN Chatterjea)	8th Edition
2. Lippincott's Biochemistry	7th Edition
3. Pre Test Biochemistry and Genetics	4th Edition
4. Instant Biochemistry (Faiq)	2nd Edition
5. Biochemistry A Case-Oriented Approach	4th Edition
6. Textbook of Physiology and Biochemistry	9th Edition
7. Harper's Illustrated Biochemistry	29th Edition
8. Hashmi's complete Textbook of Biochemistry	5th Edition
9. BRS Biochemistry Molecular Biology & Genetics	5th Edition
10. Kaplan Medical Biochemistry and Genetics	
11. Essentials of Medical Biochemistry vol1	7th Edition
12. Essentials of Medical Biochemistry vol 2	7th Edition
13. Clinical chemistry : Principles, Methods and Interpretations	3rd Edition
14. Textbook of Biochemistry with clinical correlations	6th Edition
15.Clinical chemistry (MARSHALL)	2nd Edition
16.Organic Chemistry (Vollhardt)	
17.Mathews Van Holde Biochemistry	