



NUMS
NATIONAL UNIVERSITY
OF MEDICAL SCIENCES

**MBBS
Year-I
2023**

STUDY GUIDE

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1. VISION/MISSION STATEMENTS

Vision Statement

The CMH Lahore Medical College and Institute of Dentistry aims to provide a highly conducive environment to train a new generation of technology savvy and socially responsible healthcare providers who are well-versed with their role within a healthcare team and while serving the community, demonstrate abilities to practice requisite communication skills, empathy, lifelong learning, critical thinking and decision making at a national or an international facility.

Mission Statement

The mission of CMH Lahore Medical College and Institute of Dentistry is to undertake following steps to materialize their vision:

1. Ensure provision of a conducive educational environment where students feel well-supported through implementation of learner-centered teaching approaches, inbuilt strong feedback loops and physically comfortable learning environment.
2. Sensitization of students about their role in the society as socially responsible professionals through participation in extracurricular activities like community-based programs, patient welfare societies, blood donors' society, and productive contribution to combat local and national calamities.
3. Students' exposure to the healthcare community, where sympathy and empathy are the cornerstones of our practice. Students commit to understanding their patients not only through their medical conditions but also through their emotions, fears, and unique life experiences. By fostering a culture of compassion, students aim to provide not just medical care but genuine understanding and support to enhance the well-being of those we serve.
4. Students' exposure to cutting-edge technology through campus learning management system and development of their e-portfolios.
5. Leadership and Smart Learning Strategies through implementation of interprofessional curriculum for undergraduate health professions' education students enrolled in medical, dental, allied health sciences, and nursing programs.
6. Provision of opportunities to undergraduate and post-graduate students to have practical experience of leading, working as a team member, critical thinking, problem solving, and decision making.
7. Formal teaching and training of professionalism for students to develop their full potential including communication, and lifelong learning skills through portfolio development among undergraduate and postgraduate students.
8. Implementation of a task-based and outcome oriented longitudinal module on 'Research' for undergraduate students, leading to publication of research article/s and for cultivation of evidence-based practices.

2.GUIDELINES AND INTRODUCTION

DEPARTMENT OF BIOCHEMISTRY

INTRODUCTION

Biochemistry is the mainstay of modern medicine and advances in biochemistry have revolutionized our understanding of life. Biochemistry department at CMH Lahore Medical College & Institute of Dentistry excels in imparting clinically relevant knowledge of biochemistry to future medical doctors and allied health specialists. A highly qualified, well trained and proficient team of senior and junior faculty members is geared to take up the challenging academic assignments and student participation is actively encouraged to enhance productivity. The department is currently imparting undergraduate education in MBBS, BDS, Nursing, MIT and DPT programs. The department is also approved by CPSP for postgraduate FCPS training in Biochemistry. The department is fully equipped with teaching aids and laboratory facilities, and follows an efficient teaching methodology which includes interactive formal lectures, tutorials, flipped classroom, small group discussions and practical classes. Hand-on training in diagnostic biochemistry (renal function tests, liver function tests, cardiac profile, blood glucose, bone markers and urinalysis) is also provided to students. A comprehensive modular schedule forms the basis of academic teaching and performance evaluation, and provides rigorous examination drill to the students.

Career counselling and research orientation are also given to every new batch of incoming students. Students are encouraged to take up research projects. Establishment of research on firm grounds is a departmental priority and excellent progress is being made in this matter. The department is successfully running continuous professional development programs including Journal Club, Faculty Skills Enhancement (FSE) and Train & Share Initiative (TSI) to augment the learning of the faculty members and students in order to achieve excellence at the individual, departmental and organizational levels. The 'Faculty Skills Enhancement' (FSE) workshops are regularly organized by the department of Biochemistry under the auspices of School of Health Professions Education (SHaPE). The workshops are conducted by eminent external facilitators for and are open for participation by all institutional faculty members. The 'Train & Share Initiative' (TSI) is an intradepartmental program of the Biochemistry department that has been set up recently with an aim to develop a continuous cycle of learning, sharing and

improvement. Regular bimonthly journal club meetings are held for the development of research skills including but not limited to critical appraisal, research methodology, manuscript writing and research dissemination, improvement of existing research practices and formulation of future research ideas. Extracurricular activities are also a key part of the departmental philosophy and faculty members are actively engaged in CMH Life line Society, Character Building Society, Indoor games Society to name a few. Biochem News & Views is a monthly digital newsletter launched recently to inform about the curricular and co-curricular activities taking place in the department.

The department is headed by Prof. Dr. Syed Imran Ali Shah who did his medical graduation from the top-ranking King Edward Medical University and then did MPhil in Medical Biochemistry from University of Health Sciences. He then went on to complete his PhD from the prestigious Imperial College London. He has over 16 years of experience in medical teaching and health sciences research. He holds several local and international certifications, accreditations and memberships. He has been awarded international honours for his accomplishments, including participation in Nobel Laureates Meeting (Germany), Research internship (Japan), Commonwealth scholarship (UK) and Royal reception by Queen Elizabeth II to name a few. Prof. Shah has published 100+ papers in renowned medical and allied health journals and presented his work at leading conferences in the USA and Europe. He has also co-authored books on medical biochemistry.

GUIDELINES

1. 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 has been updated with 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.

2. 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.

3. Level of integration

NUMS will follow Correlation i.e level 7 of Harden's level of Integration in first four years. The emphasis remains on disciplines or subjects with subject-based courses taking up most of the curriculum 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. However clinical teaching increases gradually with advancing years. MBBS Year V is for clerkships

4. Curricular organization and structure

- a. NUMS MBBS curriculum in the first four years shall be delivered in a System Based Modular Format with clinical relevance. However, in year III & IV, students shall get clinical exposure through rotations in the wards and OPDs and in Year V through clerkships
- b. There will be three blocks in year I, each will have modules, duration of which depends upon the number and complexity of the objectives to be achieved in that module

- c. The curriculum will be delivered by modular teams of multidisciplinary basic science faculty and relevant clinical faculty.
 - d. The planning and delivery will be coordinated by year coordinators who will guide module coordinators of their respective years for efficient implementation
 - e. Modular Coordinator will be responsible for teaching and assessment during each module. S/he will be appointed by HoDs in coordination with HPE team
 - f. Clinical Coordinator will be responsible for placement, teaching and assessment during clinical rotations
 - g. All NUMS colleges will provide study guides of each module to the students
 - h. To attain the integration in MBBS program, teaching shall be done in three spirals followed by Clerkships in final year
 - 1) **Basics of Medicine (Spiral I -Years I & II):** 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.
 - 2) Longitudinal themes (Behavioral Sciences and Research Methodology & EBM) are an integral part of year I & II
 - 3) Islamiat and Pakistan Studies are compulsory subjects taught throughout the year in first and second year respectively
 - 4) Apart from attending daily scheduled sessions, students should engage in self-directed learning to achieve the desired objectives
 - 5) 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
5. **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: -

- a. Medical Knowledge
- b. Procedural skills
- c. Problem solving
- d. Communication skills
- e. Professionalism
- f. Research

6. Outcomes

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

- a. Correlate the developmental and anatomical knowledge of different organ systems of human body to their physiological and biochemical basis.
- b. Comprehend the significance of behavioural sciences for medical students
- c. Analyze multiple perspectives of Islamic studies or ethics and Pakistan studies
- d. Discuss the basic principles of research

7. Academic calendar Year I

Blocks (34 wks)	I (14 weeks)					II (10 weeks)		III (10 weeks)		
	02	02	06	03	01	09	01	04	05	01
Modules	Foundation-I	Cell Structure & Function	MSK - I	Haem & Immunology- I	EOB	Cardiovascular System - I	EOB	Respiratory system - I	MSK - II	EOB
Integration: Anatomy, Physiology, Biochemistry, relevant clinical disciplines										
Across the year : Behavioral Sciences, Research Methodology and Islamiat										

8. Contact Hours Distribution Year-I

SUBJECTS	CONTACT HOURS
Anatomy	250
Physiology	225
Biochemistry	125
Medicine & Allied	30
Surgery & Allied	30

Research Methodology & EBM	20
Islamiyat	15
Self-Directed Learning	100
Cocurricular activities	40
Total Hours	835

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

- a. Interactive Lectures
- b. Small group discussion
- c. Lab practical
- d. Skill lab
- e. Problem based learning/ Case based learning
- f. Tutorials
- g. Integrated sessions using any of the above strategies
- h. Self-directed learning (SDL) and directed self-learning (DSL)

10. Resources. To be filled in by the institute

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

11. 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 one pre-annual examination in year I, which contributes towards the weighting of internal assessment i.e 20% in first professional MBBS Examination.

12. Annual Professional Examination.

The University will take the first professional Examination 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

13. Evaluation of the Course. To be filled in by the institute.

- a. The major goals of the evaluation are to monitor quality of and improve curriculum
- b. 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

- c. Faculty suggestions if any, for improvement of curriculum and teaching may be incorporated in the next session

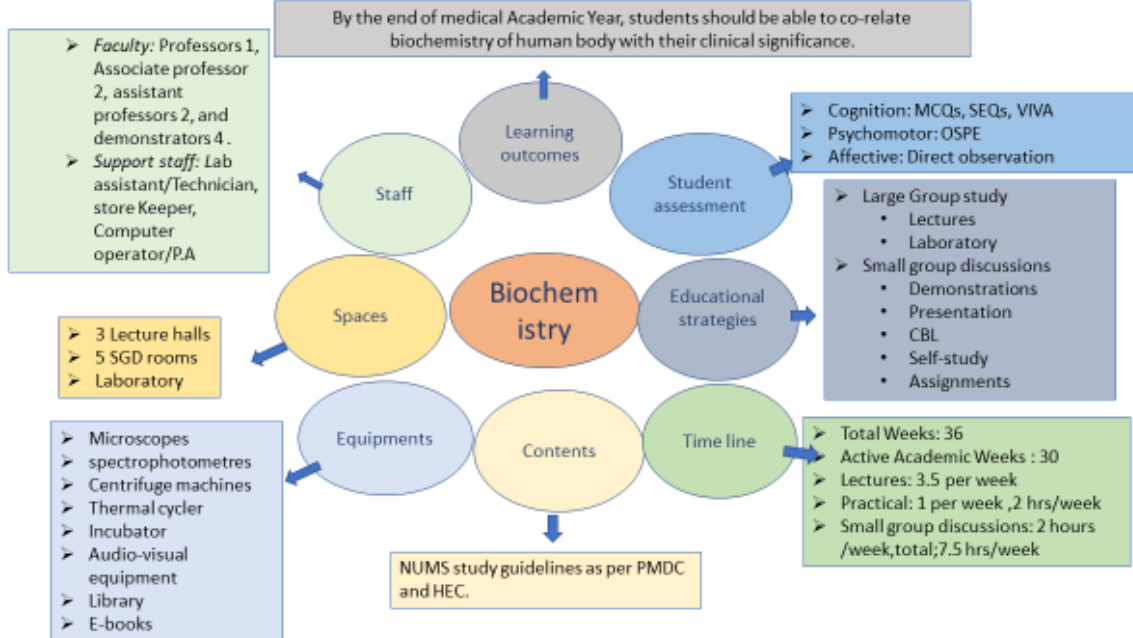
14. Implementation of curriculum

- a. 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
- b. Early clinical exposure may be achieved by allocating hours to skill labs, Medicine & Surgery ward visits in each module or patient may be brought before the students as per the decision of institute

3.CURRICULUM MAP

CURRICULUM MAP OF BIOCHEMISTRY DEPARTMENT

Curriculum Map Biochemistry Department (MBBS)



BLOCK-I MODULES

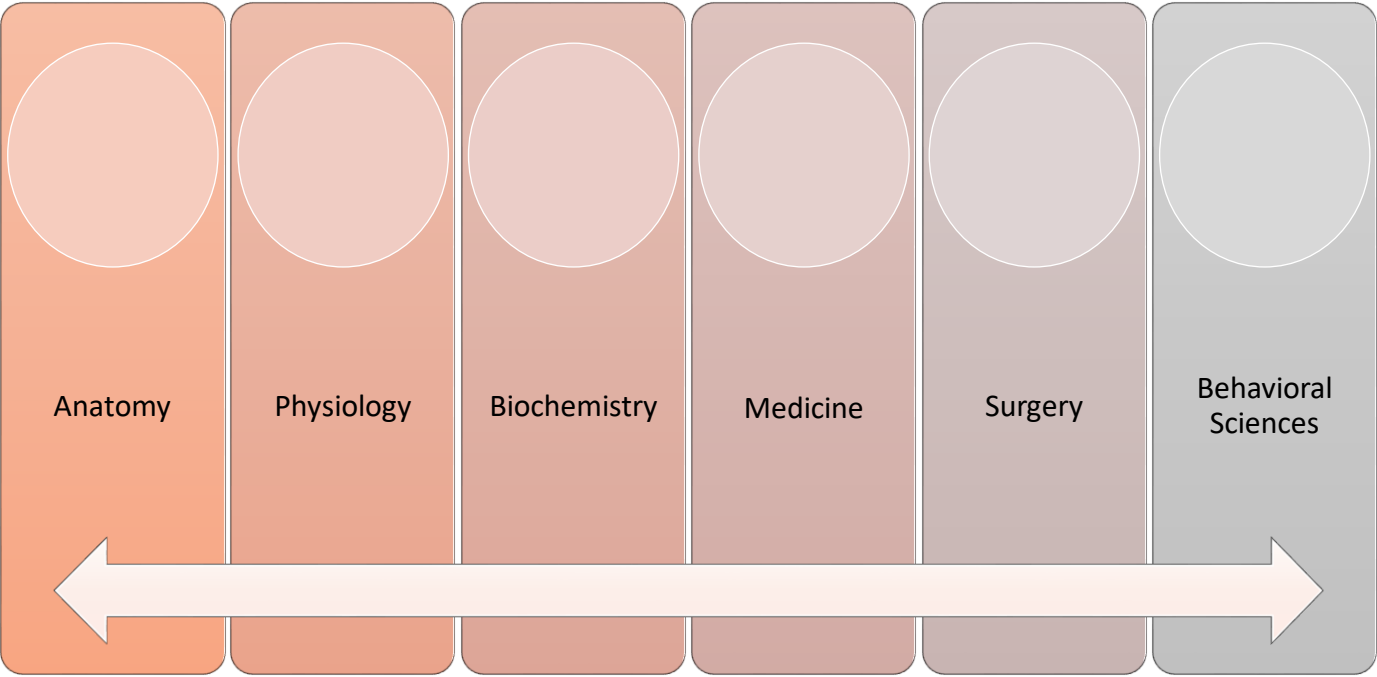
MODULE NO.	MODULE TOPICS
1.	Foundation module
2.	Cell Structure and Function
3.	Musculoskeletal System I (Carb Chemistry and Metabolism)
4.	Heme & Immunology

BLOCK 1

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

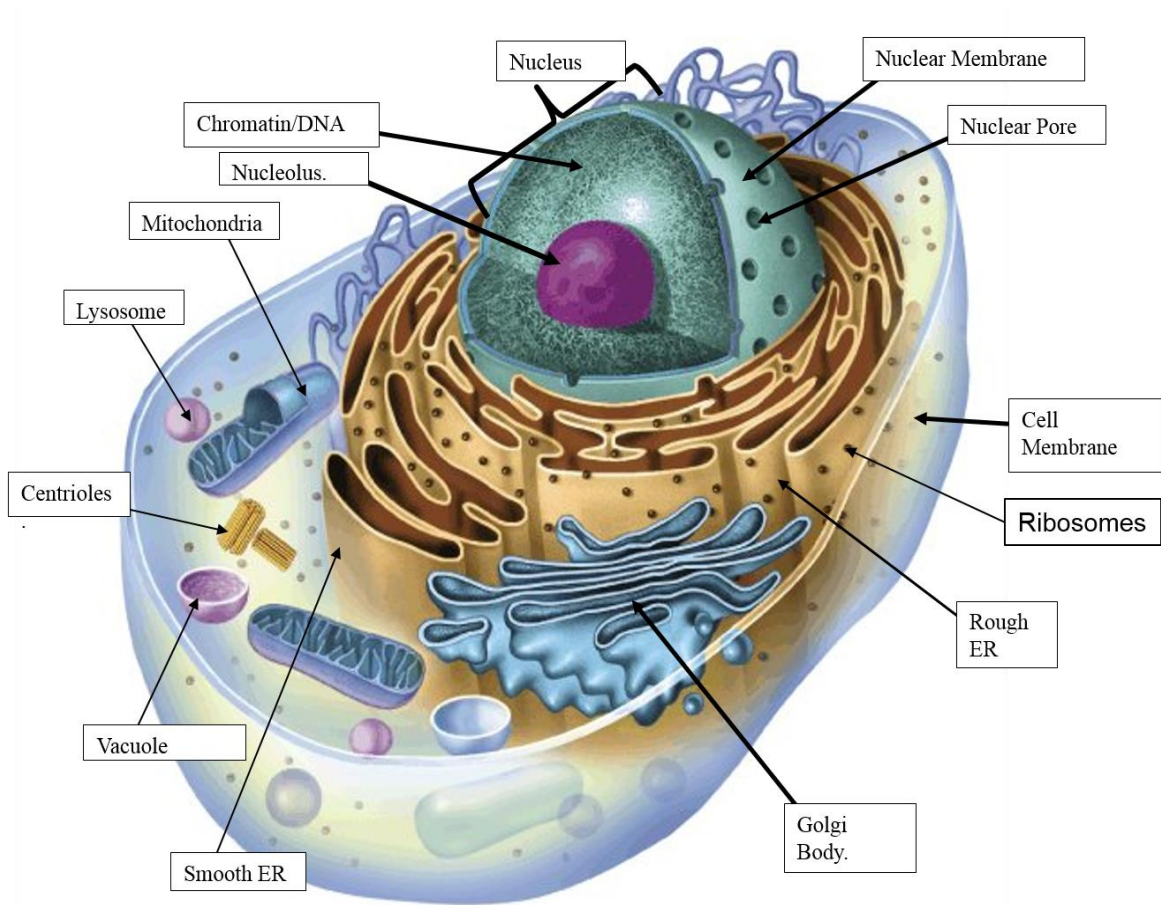
Course Outline

BIOCHEMISTRY

1	Introduction	Comprehend the basic concepts of biochemistry		Lecture	Formative
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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	<ul style="list-style-type: none">• 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

CELL STRUCTURE AND FUNCTION – 2 weeks

S.No	Topic/ Theme	Learning outcomes	Learning Objectives/Contents	Instructional strategies	Assessment tool
		By the end of this module, students will be able to:			

BIOCHEMISTRY

S.No	Topic/ Theme	Learning outcomes	Learning Objectives/Contents	Instructional strategies	Assessment tool
1.	Cell	List various Biomolecules	<ul style="list-style-type: none"> • Explain Cell Biochemistry • Elaborate various Biomolecules 	<ul style="list-style-type: none"> • Lectures • SGD 	<ul style="list-style-type: none"> • MCQ • SAQ/SEQ • Structured viva
		Differentiate between Cell Organelles, their structure, biochemical functions and associated disorders	<ul style="list-style-type: none"> • 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 		

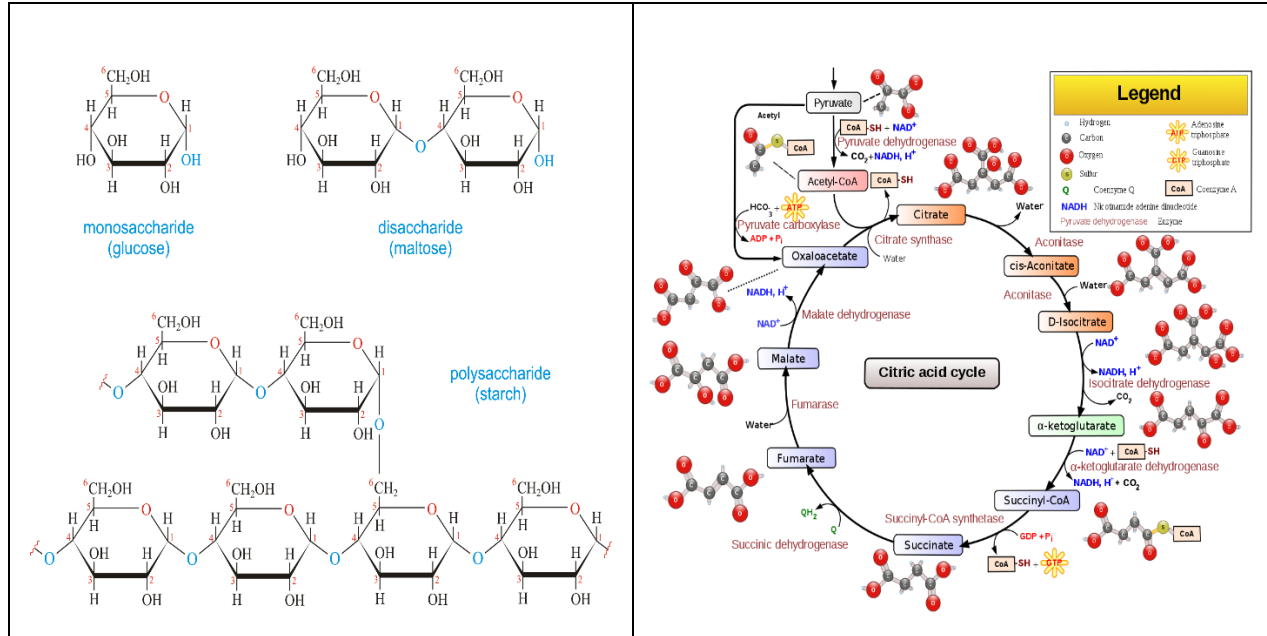
		List various Cytology techniques for study of a cell	<ul style="list-style-type: none"> • Comprehend various Cytology techniques for study of a cell 		
		Discuss the chemical composition of a cell membrane and its significance regarding a particular cellular environment	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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		<ul style="list-style-type: none"> • Introduction to use of laboratory glassware • Introduction to use of laboratory equipment <ul style="list-style-type: none"> ➤ Spectronic 20, microlab, incubator, water bath, hot oven, centrifuge, electronic balance • Preservation and collection of clinical specimen 	•	•

BLOCK 1

MODULE 3: Musculoskeletal System (6 weeks)

(Carbohydrate Chemistry and Metabolism)



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 Islamiyat 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

BIOCHEMISTRY

Topic/ Theme	Learning outcomes	Learning Objectives/Contents	Instructional strategies	Assessment tool
Carbohydrate Chemistry	Analyze the significance of different carbohydrates in medicine	<ul style="list-style-type: none"> • Classify Carbohydrates and explain their Biochemical functions • Discuss the structure and functions of Monosaccharides and enumerate their various derivatives • Explain the structure and functions of Disaccharides with examples • Describe Oligosaccharides and their combination with other macromolecules <ul style="list-style-type: none"> ➤ Enumerate important examples of Polysaccharides and give their biochemical role 	Lectures/SGD	MCQ SAQ/SEQ
Digestion and absorption of Carbohydrates	Discuss the digestion and absorption of Carbohydrates	Overview of digestion and absorption of Carbohydrates	Lectures/SGD	MCQ SAQ/SEQ

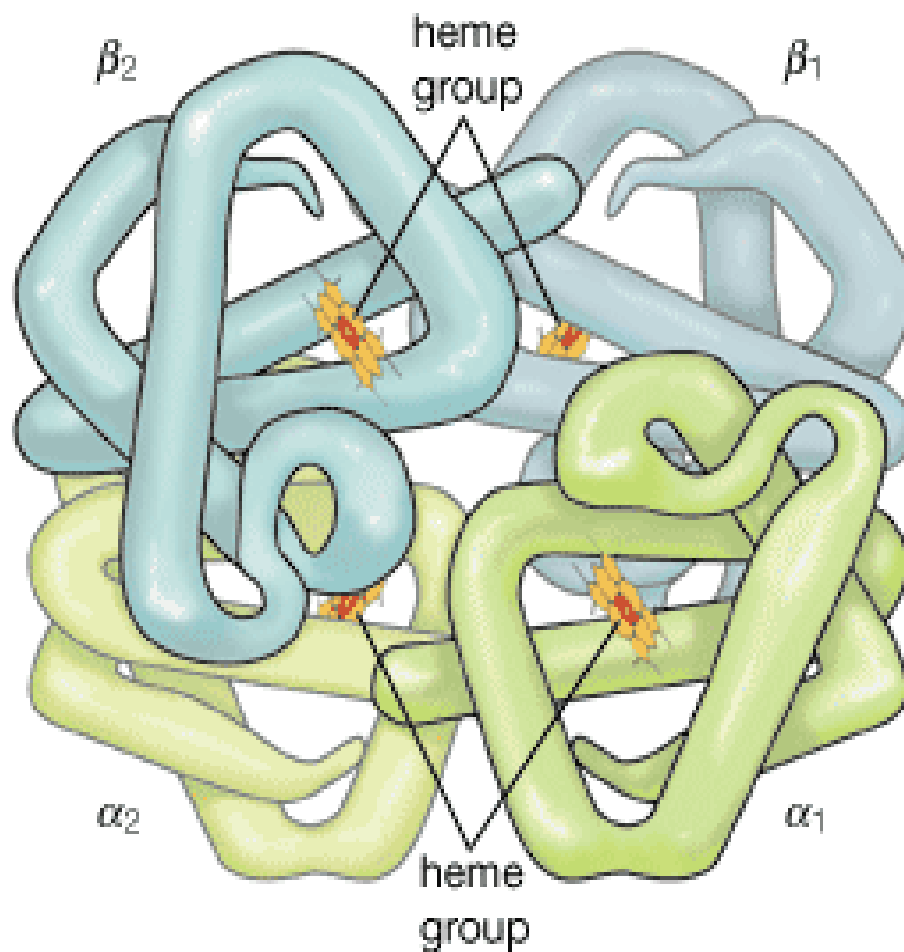
Metabolism of Carbohydrates	Apply the knowledge of carbohydrate metabolism for understanding relevant metabolic disorders	<ul style="list-style-type: none"> • Outline the Phases reactions of Glycolysis and regulation of Glycolysis • Describe the bioenergetics of Aerobic and Anaerobic glycolysis and their biochemical importance • Discuss fate of Lactic acid & Pyruvate • Draw Cori's cycle • Outline the Citric Acid Cycle-Reactions • Describe the energetics, regulation, importance and amphibolic nature of citric acid cycle. • Discuss Gluconeogenesis & state the three important bypass reactions & significance of gluconeogenesis • Compare and contrast Glycolysis & gluconeogenesis • Discuss the Glycogen Metabolism & Write down the reactions of Glycogenesis and glycogenolysis. • Outline the importance of UDP-Glucose & regulation of Glycogen metabolism • Describe the disorders of Glycogen metabolism (Glycogen Storage Diseases) • Compare and contrast Glycogenesis and glycogenolysis 	Lectures/SGD	MCQ SAQ/S EQ
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		<ul style="list-style-type: none"> • Describe Hexose Mono Phosphate Shunt, its reactions and importance • Explain Glucuronic acid pathway, its reactions and importance • Describe the metabolism of Fructose, Galactose and Lactose 		
Practicals	Perform and interpret the results	<ul style="list-style-type: none"> • Estimation and clinical interpretation of Glucose in blood • Estimation and clinical interpretation of plasma enzyme Amylase • Experiments on Carbohydrates qualitative analysis-I • Molisch test • Experiments on Carbohydrates qualitative analysis-II • Benedicts test • Fehlings test • Experiments on Carbohydrates qualitative analysis-III • Iodine test • Seliwanoff test • HbA1c Interpretation 	Practical	

BLOCK 1

MODULE 4: Heme & Immunology (3 weeks)

(Porphyrin and Hemoglobin + Plasma Proteins and Immunoglobulins)



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

<i>TOPICS</i>	<i>OUTCOMES</i>	<i>Disciplines</i>
	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

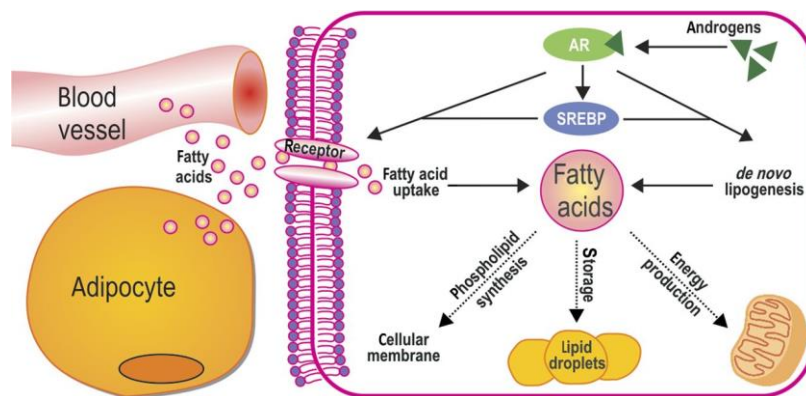
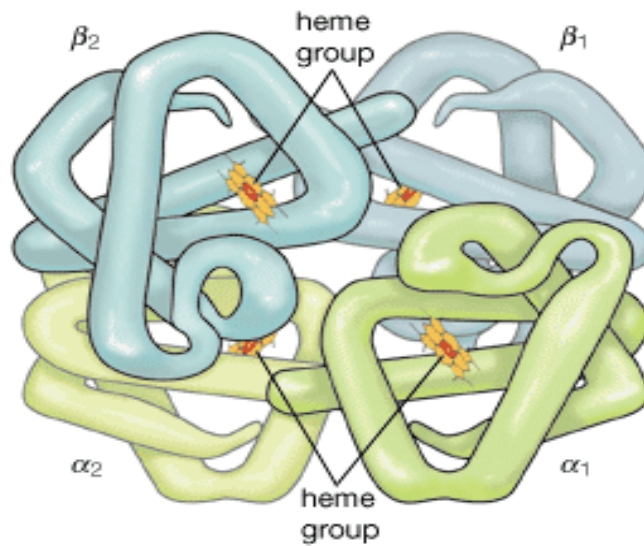
Module IV					
Hematology and immunology					
BIOCHEMISTRY					
Sr	TOPIC/THEME	Learning Outcomes	Learning Objectives/Contents	Instructional strategies	Assessment tool
1.	Porphyrin and Hemoglobin	Correlate the biochemical basis of Porphyrin and Hemoglobin with clinical conditions	<ul style="list-style-type: none"> Enumerate various types of Hemoglobin and explain its functions in detail Discuss the Oxygen binding capacity of hemoglobin with reference to the O₂-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 	<ul style="list-style-type: none"> Lectures SGD 	

			<p>heme, formation of bile pigments, their types, transport and excretion</p> <ul style="list-style-type: none"> • Discuss Hyperbilirubine mia and jaundice • Explain various Hemoglobinopathies (Hb-S,Hb-C, Hb-SC, Methemoglobinopathies and thalassemia) and elaborate their biochemical causes 		
2.	Plasma proteins and Immunoglobulins	Relate the basic knowledge of Plasma proteins to its clinical significance	<ul style="list-style-type: none"> ➤ Define Plasma proteins & give their clinical significance ➤ Draw and label the Structure of Immunoglobulins ➤ Enumerate major types, functions & Properties of Immunoglobulin 	<ul style="list-style-type: none"> • Lectures • SGD 	OSPE
	Practicals	Interpret the results	<ul style="list-style-type: none"> ➤ 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Lectures SGD CBL/PBL 	<ul style="list-style-type: none"> MCQ/SAQ/SEQ

			<ul style="list-style-type: none"> • Application of enzymes in clinical diagnostics and therapeutics (Describe the role of Troponins in diagnosis of MI) 		
2	Lipid Chemistry	Relate the significance of different lipids in medicine	<ul style="list-style-type: none"> • 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
	Digestion and absorption of lipids	Discuss the digestion and absorption of lipids	<ul style="list-style-type: none"> • Overview of digestion & absorption of Lipids 	Lecture/ SGD/ CBL	MCQ/SAQ/ SEQ/Struc tured Viva

3	Lipid Metabolism	Apply the knowledge of lipid metabolism for understanding relevant metabolic disorders	<ul style="list-style-type: none"> • 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 Triglyceride metabolism • Explain Mechanism of synthesis of ketone bodies and give their utilization and significance in 	Lecture/SGD/CBL	MCQ/ SAQ/ SEQ/ Structure dViva
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			<p>body. Define Ketosis and explain its mechanism</p> <ul style="list-style-type: none">• Explain the steps of Cholesterol synthesis along with its regulation.• Enumerate functions and fate of Cholesterol in the body.• Differentiate 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 apolipoproteins and their role in lipoprotein metabolism		
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Practicals					
	Practical	<ul style="list-style-type: none"> Analyze the results of given experiment Study the various enzymes related to myocardial infarction 	Rancidity of Fats Estimation & clinical interpretation of serum cholesterol Lipid profile LDH CK Trop T	Practical	OSPE

BLOCK III

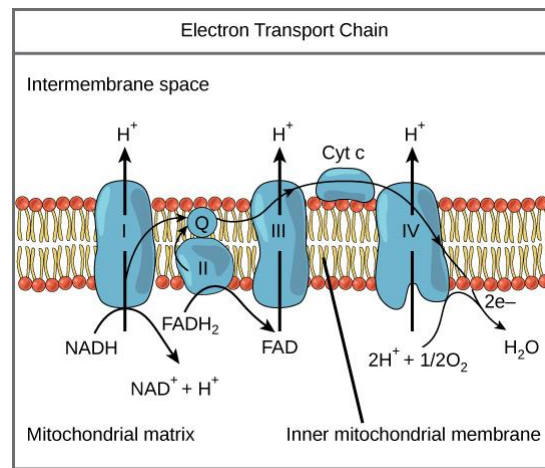
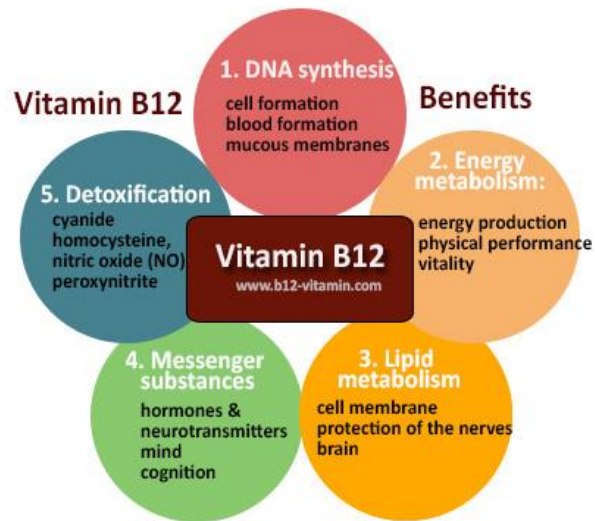
MODULE 6: Respiratory System

MODULE 7: Musculoskeletal System II

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

<i>TOPICS</i>	<i>OUTCOMES</i>	<i>Disciplines</i>
	By the end of this module, student should be able to:	
Bioenergetics and Biological Oxidation	<ul style="list-style-type: none">• Justify the role of ATP and energy metabolism in health and disease	Biochemistry
Vitamins	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Classify vitamins • Relate the knowledge of water soluble and fat soluble vitamins for understanding of its deficiency and excess 	<ul style="list-style-type: none"> • Classify various types of vitamins • Discuss chemistry, sources, biochemical functions, daily 	Lecture/ SGD/ CBL	MCQ/ SAQ/ SEQ

		manifestations	<p>allowance, deficiency manifestations and toxicity of water soluble vitamins (Vitamin C & B complex)</p> <ul style="list-style-type: none"> • Discuss chemistry, sources, biochemical functions, daily allowance, deficiency manifestations and hypervitaminosis of fat soluble vitamins (vitamin A, D, E & K) 		
	Practicals	Estimate Ascorbic acid in orange juice by titration	Estimation of Ascorbic acid in orange juice by titration.		

BLOCK III

MODULE 7: Musculoskeletal System II (5 weeks)

(Minerals)

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

<i>TOPICS</i>	<i>OUTCOMES</i>	<i>Disciplines</i>
	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

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

Theme
Waddling Gait
Swollen knee joint
Foot drop
Numbness in leg

BIOCHEMISTRY				
Topic/ Theme	Learning outcomes	Learning Objectives/Contents	Instructional strategies	Assessment Tool
Mineral & Trace Elements	Apply the basic knowledge of minerals for understanding their related disorders	<ul style="list-style-type: none"> ➤ Classify minerals ➤ Write down the sources, biochemical role and related diseases of Macro minerals (Na, K, Ca, Cl, PO₄, Fluorine, Sulphur) in human body ➤ Write down the sources, biochemical role and related diseases of Micro minerals (Fe, Zn, Mg, Se, I, Cu, Cr, Cd, Mn) 	<ul style="list-style-type: none"> • Lectures • SGD 	MCQ/SAQ/SEQ
Practicals		Serum Electrolyte Analyzer	Practical	OSPE

5.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

A child is brought to the dermatology department with complaints of dry and scaly skin. His mother complaints that he does not consume any dairy or meat products and prefers junk food only. This patient is most likely deficient in which of the following?

- a. Linolenic acid
- b. Oleic acid
- c. Palmitoleic acid
- d. Stearic acid

KEY: A

Short essay question (SEQs)

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

Sample SEQ

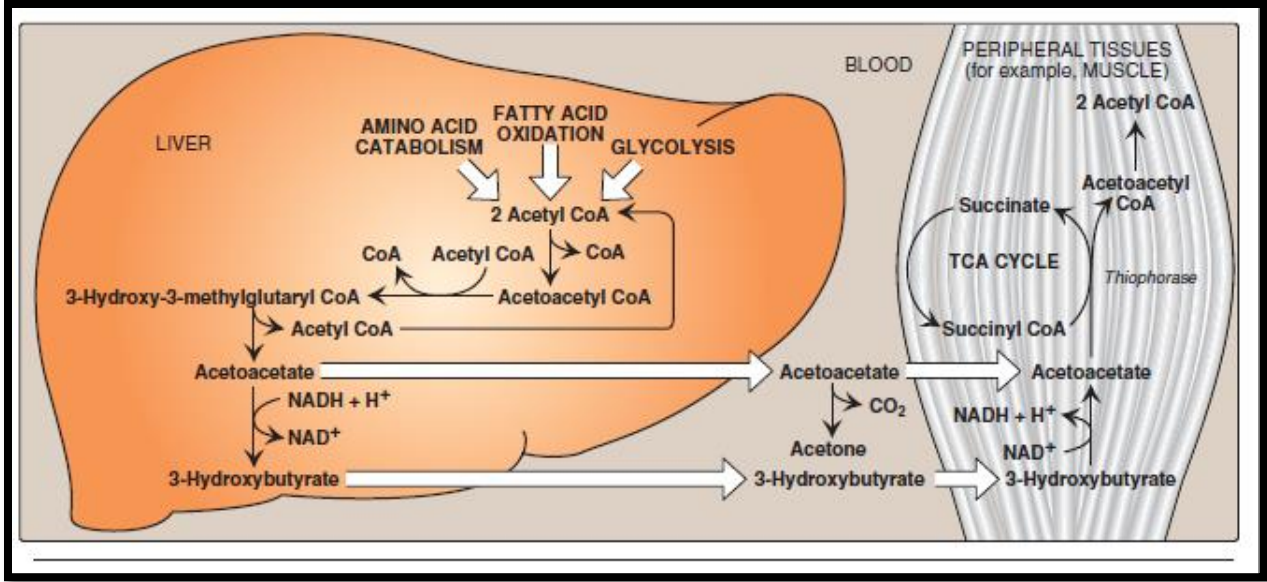
A 45 year old obese type I diabetic male presents in the emergency with loss of consciousness for the past half an hour. His blood sugar levels came out as 350 mg/dl and urinary ketones turned out to be positive. He is diagnosed with Diabetic ketoacidosis and started on insulin therapy. What is the pathogenesis of diabetic ketoacidosis? Draw the steps of ketogenesis and ketolysis along with enzymes? (1+4)

KEY:

Diabetic ketoacidosis: (1)

Decreased insulin and increased glucagon in uncontrolled diabetes leads to increased lipolysis and hence increased release of free fatty acids in the plasma. This in turn causes increased beta oxidation and increased output of hepatic ketone bodies which are acidic in nature and thus reduce the pH of blood.

Ketone body synthesis and utilization : (4)



6.FACULTY LIST

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Hafiz Muhammad imran	35201-3270734-1	B.A, Hafiz	Laboratory Attendant
Salman Ahmad	35401-2071443-3	Matric	Office Orderly

7.DEPARTMENTAL LIBRARY

Departmental library

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