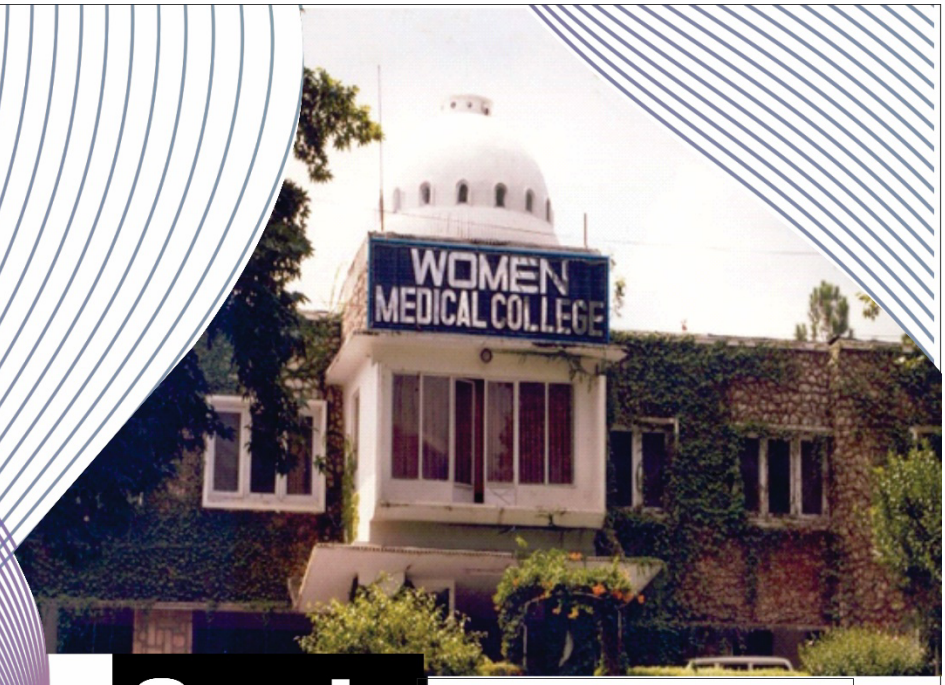

Study Guide

BIOCHEMISTRY

WOMEN MEDICAL COLLEGE

A b b o t t a b a d

WMC

WOMEN MEDICAL COLLEGE

ABBOTTABAD

Created by:

Dept. Medical Education & Research (DME&R)

DEPARTMENT OF BIOCHEMISTRY
WOMEN MEDICAL COLLEGE,

ABBOTTABAD.

Table of Contents

DESCRIPTION: Department of Biochemistry

The Department of Biochemistry at Women Medical College is presently engaged in Preparing the students to learn basic knowledge of Biochemistry. Special emphasis is given on the applied aspects to have a better command on human chemistry with relevance to common functional disturbances.

OVERVIEW:

Program	Bachelor of Medicine, Bachelor of Surgery

Contact Hours Total	Total: 200
Infrastructure Requirements	Lecture Halls Demonstration room Practical Laboratory

FACULTY RESPONSIBLE FOR COURSE CONDUCTION:

Details of teaching, non-teaching faculty

TEACHING FACULTY:

S.No	Name	Qualification	Designation
1	Prof Dr Uzma Faryal	MBBS,MPhil,PhD (Biochemistry), CHPE	Head and Prof of Biochemistry
2	Dr Bibi hajira	MSc, MPhil, PhD (Biochemistry)	Associate Professor
3	Dr Shahid ullah Khan	MSc, MPhil, PhD (Biochemistry)	Assistant Professor
4	Dr Javeria Saqib	MSc, MPhil, PhD (scholar)	Senior Demonstrator
5	Dr Rabia Gul	MBBS	Demonstrator
6	Dr Marzia Batool	MBBS	Demonstrator

NON-TEACHING FACULTY

S.No	Name	Qualification	Designation
1	Mr Shehzad	Matric,FSc	Lab Technician
2	Miss Kiran	MSc Computer sciences	Computer Operator
3	Miss Sonia	Matric	Store keeper
4	Mr Qari Naseer	Matric	Lab attendant

CLASS: FIRST-YEAR MBBS

Modules for First-Year MBBS

Paper A: Foundation module + Blood and Immunology module

Paper B: Musculoskeletal module

Paper C: CVS module + Respiration module

Module 1 Foundation

1. **Foundation Module (6 Weeks)**

   Themes for Foundation module:

SNO	Theme	Duration
1.	Orientation	1 week
2.	Cell	1 week
3.	Growth & Development of Human Body	2 weeks
4.	Human Body tissues, bones & joints	2 weeks

THEME: ORIENTATION

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1.	**Introduction to biochemistry and its implication in medicine.**	Define biochemistry. Discuss the role of biochemistry in medicine.	1 hour	LGF SGF SDL	MCQs

THEME: CELL

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1.	**Biochemical structure of cell. Biochemical structure of Mitochondria**	Explain the Bio-chemical composition of cell organelles and cytoplasm. Describe the chemical structure of mitochondrial membrane. Explain the biochemical importance of mitochondrial membrane.	1 hour	LGF SGF SDL	MCQs
2.	**Nuclear membrane**	Describe Bio-chemical structure of nuclear membrane and its functions.	1 hour	LGF SGF SDL	MCQs
3.	**RNA & DNA**	Define and explain nucleotides and nucleosides. Describe the components of nucleotides Describe the functions of Nucleotides Describe the types of nucleic acids Differentiate between RNA and DNA.	1 hour 1 hour	LGF SGF SDL LGF SGF SDL	MCQs
4.	**Buffer**	Define Buffer and its role in maintenance of body PH Define colloidal state and Henderson Hasselbalch equation. Define adsorption and how it occurs. Explain ion exchange resin	1 hour	LGF SGF SDL	MCQs
5.	**Cellular membrane transport mechanism**	Explain membrane transport. Discuss passive diffusion, active transport, and facilitated transport via a channel or carrier. Describe and evaluate the role of ion gradients, co transporters, and ATP in active transport mechanisms.	1 hour	LGF SGF SDL	MCQs

LAB WORK

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1.	**The Microscope**	Identify parts of microscope. Demonstrate operation of microscope. Describe the method of focusing slide at different magnifications. Follow the specified norms of lab work.	1.5 hour	Practical Demonstration Performance	OSPE Viva Practical Notebook
2.	**Lab Equipment**	Introduction to lab techniques Identify the equipment used in lab work	1.5 hour	Practical Demonstration Performance	OSPE Viva Practical Notebook
3.	**PH and buffer solutions**	Define normal solution Define standard solution. Prepare 0.1N solution of NaOH. Prepare 0.1N solution of HCL. Measure the PH of given solution (practical).	1.5 hour	Practical Demonstration Performance	OSPE Viva Practical Notebook

THEME: GROWTH & DEVELOPMENT OF HUMAN BODY

S. No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1.	**Chemistry of Acids and Bases**	Define acids, bases. Describe strong acids and weak acids. Describe strong bases and weak bases. List different types and sources of acids and bases in our body. Describe the mechanism of their normal balance and biochemical importance.	1 hour	LGF SGF SDL	MCQs
2.	**Importance of surface tension and viscosity in our body**	Explain surface tension, viscosity, vapor pressure, normal boiling point and capillary action.	1 hour	LGF SGF SDL	MCQs
3.	**Carbohydrates –I**	Describe carbohydrates and give their Bio-chemical importance. Classify Carbohydrates. Explain carbohydrate and its Bio-chemical structure. Describe the different isomers of monosaccharides. e.g. Galactose, mannose, fructose, dextrose. Describe the role of dextrose in I/V infusion.	1 hour 1 hour	LGF SGF SDL	MCQs

		Describe the role of mannitol in cerebral edema.			
4.	**Carbohydrates –II**	Describe the structure of disaccharides and oligosaccharides.	1 hour	LGF SGF SDL	MCQs
5.	**Carbohydrates –III**	Relate the structure of polysaccharides with its clinical importance. List the functions of carbohydrates in cell membrane, energy provision and nutrition supply to different parts of body.	1 hour	LGF SGF SDL	MCQs

LAB WORK

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Detection of Monosaccharide's**	Define Monosaccharide's Discuss structure and types Perform the sequence of tests to identify the monosaccharides in a given solution.	6 hrs	Practical Demonstration Performance	OSPE Viva Practical notebook
2	**Detecting of Reducing and non-reducing Sugars**	Define reducing sugars, types. Discuss structure and types of reducing sugars Perform Benedicts test	4.5 hrs	Practical Demonstration Performance	OSPE Viva Practical notebook
3	**Detection of Polysaccharides in a givenSolution**	Define Polysaccharides. Discuss structures and types of Polysaccharides Perform the sequence of tests to identify the polysaccharides in a given solution.	3 hours	Practical Demonstration Performance	OSPE Viva Practical notebook

THEME: HUMAN BODY TISSUES, BONES & JOINTS

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Structure and function of GAGS**	Describe the structure and function of GAGS and its clinical importance.	1 hour	LGF SGF SDL	MCQs

Module No 2

2. Blood & Immunology (5 Weeks)

Themes for Blood Module

S.NO	Theme	Duration
1	Pallor and swelling	2 weeks
2	Fever (Infection and Immunity)	2 weeks
3	Excessive bleeding & Transfusion Reaction	1 week

THEME: Pallor and Swelling

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1.	**Introduction of Porphyrins**	Define Porphyrins Describe Chemistry of Porphyrins Enlist the types, metabolic causes and clinical presentation of different types of Porphyrias.	1 hour	LGF SGF SDL	MCQs
2.	**Iron metabolism**	Describe the iron metabolism	1 hour	LGF SGF SDL	MCQs
3.	**Introduction to heme synthesis and degradation**	Define heme and Describe its structure and functions. Describe the biochemical features of	3 hours	LGF SGF SDL	MCQs

		the hemoglobin molecules. Describe Heme Synthesis on cellular and molecular level. Describe Heme Degradation. Describe the Regulation of Heme Synthesis. Describe the concept of Oxygen binding with hemoglobin. Describe the normal picture of blood chemistry.			
4.	**Hemoglobinopathies**	Define Hemoglobinopathies and enlist the variants of hemoglobin. Describe causes of Hemoglobinopathies. Describe two major categories of hemoglobinopathies. Describe the amino acid substitution in sickle cell disease. Define and Classify thalassemias. Explain the genetic	2 hours	LGF SGF SDL	MCQs MCQS

		defects in α and β thalassemias. Enlist the clinical features of α and β thalassemias.			
5.	**Water soluble vitamins**	Discuss water soluble vitamins including Vitamin B complex(B1, B2, B3,B5,B7,B9) Vitamin C Folic Acid	6 hours	LGF SGF SDL	MCQs

THEME: Fever (Infection and Immunology)

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Immunoglobulin's / Antibodies**	Define Immunoglobulin's DESCRIBE Types of Immunoglobulin's Describe Structure of Immunoglobulin's Describe the mechanism of action of antibodies Explain biochemical role of each immunoglobulin in immunity	2 hours	LGF SGF SDL	MCQs MCQs

Module No 3
3. Musculoskeletal Module (8 Weeks)

Themes for MSK Module

SNO	Theme	Duration
1	Orientation and shoulder pain	2 weeks
2	Weak grip and painful hand	1 week
3	Pain lower limb/limping	2 weeks
4	Bony arches and fracture of foot	1 week
5	Backache	1 week
6	Muscle weakness and fatigue	1week

THEME: Orientation and shoulder pain

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Connective Tissues**	Explain in detail the Biochemistry of Connective Tissues.	1 hour	LGF SGF SDL	MCQs
2.	**Glycosamino-glycans**	Discuss the role of Glycosaminoglycans (GAGs) in the formation of connective tissues, cartilage, tendons, skin, blood vessels.	1 hour	LGF SGF SDL	MCQs
3.	**Collagen**	Describe the chemical structure of cellular matrix of collagen and collagen.	1 hour	LGF SGF SDL	MCQs

4.	**Chemistry of amino acids and proteins**	Describe structure of amino acids and proteins. Classify proteins. Describe different types of plasma proteins.	8 hours	LGF SGF SDL	MCQs

LAB WORK

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Detection of Sulphur containing amino acids**	Define Sulphur containing amino acids. Lead Sulphate test.	3 hours	Practical Demonstration Performance	OSPE Viva Practical notebook

THEME II: Weak grip and painful hand

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Role of Calcium and phosphorous**	Explain the Role of Calcium and phosphorous in the formation of cellular matrix and bone.	1 hour	LGF SGF SDL	MCQs
2.	**Vitamins**	Vitamins and their role. Define vitamins. Classify vitamins. Differentiate between Fat and water soluble vitamins. Describe role of vitamins A. Explain role of vitamins D. Describe role of vitamin E. Describe role of water soluble vitamins.	5 hour	LGF SGF SDL	MCQs
3.	**Introduction to Minerals**	Define Minerals. Classify major and minor Minerals. Describe classification of Minerals.	1 hour	LGF SGF SDL	MCQs

LAB WORK

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	Detection of Cyclic amino acids	Define Cyclic amino acids. Describe their structure and type Learn and perform Xanthoproteic test	3 hours	Practical Demonstration Performance	OSPE Viva Practical notebook

THEME: Pain lower limb/limping

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Salt Saturation Test**	Perform Salt Saturation Test.	1.5 hours	Practical Demonstration Performance	OSPE Viva Practical notebook

THEME: Bony arches and fracture of foot

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Role of vitamin c & D**	Describe the role of Vitamin C and Vitamin D in the formation of connective tissues and bones.	1 hour	LGF SGF SDL	MCQs
2.	**Iodine in Biology**	Discuss RDA, serum Levels Iodine. Enlist sources of Iodine. Describe functions. Discuss absorption excretion. Describe disorders related to increase and decrease in amount of Iodine.	1 hour	LGF SGF SDL	MCQs

THEME: Backache

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Phosphorus and Magnesium in biology**	Discuss RDA, serum Levels Enlist sources of Phosphorus and Magnesium Describe functions Discuss absorption excretion, Describe disorders related to increase and decrease in amount of Phosphorus and Magnesium.	1 hour	LGF SGF SDL	MCQs
2.	**Sulphur in biology**	Discuss RDA, serum Levels Enlist sources of Sulphur Describe functions Discuss absorption excretion, Describe disorders related to increase and decrease in amount of sulphur.	1 hour	LGF SGF SDL	MCQs
3.	**Copper and cobalt in Biology**	Discuss RDA, serum Levels Copper and cobalt Enlist sources of Describe functions Discuss absorption excretion, Describe disorders related to increase and decrease in amount of Copper and cobalt.	2 hours	LGF SGF SDL LGF SGF SDL	MCQs MCQs

THEME: Muscle weakness and fatigue

S. No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1.	**Hormonal regulation .**	Explain the hormonal regulation of calcium and phosphorous to maintain musculoskeletal system.	1 hour	LGF SGF SDL	MCQs
2.	**Sodium, potassium and chlorine in biology.**	Discuss RDA, serum Levels Enlist sources of Sodium, Potassium and chlorine, Describe functions Discuss absorption excretion, Describe disorders related to increase and decrease in amount of Sodium, Potassium and chlorine.	2 hour	LGF SGF SDL	MCQs
3.	**Calcium in Biology**	Discuss RDA, serum Levels Enlist sources of Calcium. Describe functions. Discuss absorption excretion, Describe disorders related to increase and decrease in amount of Calcium.	1 hour	LGF SGF SDL	MCQs
4.	**Fluoride**	Discuss RDA, serum	1 hour	LGF	MCQs

	and Lithium in biology.	Levels Fluoride. Enlist sources and functions. of Calcium. Discuss absorption, excretion, disorders related to increase and decrease in amount of Fluoride. Brief description on role of lithium in biology.		SGF SDL	
5.	**Molybdenum, Selenium, Zinc, chromium ,manganese, silicon, vanadium in biology**	Enlist sources of Describe functions. Discuss absorption excretion. Describe disorders related to increase and decrease of the said elements.	3 hours	LGF SGF SDL	MCQs
6	**Toxic element Aluminum, Arsenic, Antimony, Boron, Bromine, Cadmium, Cesium, Germanium, Lead, Mercury, Silver,**	Discuss different effects of toxic Elements.	1 hour	LGF SGF SDL	MCQs

	Strontium				

Module No 4

4. Cardiovascular System (CVS)

Themes for CVS Module:

S.No	Theme	Week
1	Chest pain	1 week
2	Breathlessness and ankle swelling	2 weeks
3	Blood pressure	1 week
4	Palpitations	1 week

THEME: Chest pain

S. No	**Topic**	**Learning outcomes**	**Teaching Hours**	**Teaching Strategy**	**Assessment Tool**
1	**Cardiac enzymes**	Identify the enzymes that increase in myocardial infarction	1 hour	LGF SGF SDL	MCQs
2	**Lipids and cholesterol**	Describe the Chemical Structure and function of cholesterol Describe the fate of cholesterol in the body	1 hour	LGF SGF SDL	MCQs
		Define and Classify lipids Describe the functions of lipids in the body	1 hour	LGF SGF SDL	MCQs
		Classify lipoproteins and their	1 hour	LGF	MCQs

		functions		SGF SDL	
		Describe Cardiac enzymes and their pattern of elevation in ischemic heart diseases Describe the role of Na, K, Ca and Mg in cardiac muscles contractility and their biochemical abnormalities Describe the cardiac manifestations of vitamin B1 deficiency	1 hour	LGF, SGF SDL,	MCQs

Module No 5

5. Respiration Module (4 Weeks)

Themes for Respiration module:

S.No	Theme	Week
1	Cell wall injury	1 week

2	Cough and Hemoptysis	1 weeks
3	Breathlessness	2 week

THEME: Breathlessness

S. No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1	**Enzymes**	Define Enzymes Define activation energy Define Gibbs Free energy Explain the general structure of enzymes Describe the mechanism of Enzyme activity	1 hour	LGF SGF SDL	MCQs
2.		Define co-factors, co enzymes, prosthetic group Explain the functions of co-factors Enlist different types of cofactors	1 hour	LGF SGF SDL	MCQs
3		Define catalysis Explain different mechanism of catalysis	1 hour	LGF,SGF SDL,CBL	MCQs
4		Explain the Principals for Nomenclature of enzymes Classify Enzymes on the basis of functions	1 hour	LGF SGF SDL	MCQs
5		Enlist the factors affecting the activity of enzymes	1 hour	LGF SGF	MCQs

		Describe roles of factors affecting enzyme activity		SDL	
6.		Define enzyme kinetics Explain different areas of enzyme kinetics Describe the role of Km in Enzyme kinetics		LGF SGF SDL	MCQs
7		Define Isoenzymes (Isozymes) Explain Factors affecting the properties of isozymes Define Ribozymes	1 hour	LGF SGF SDL	MCQS
8.		Explain the role of enzymes as a diagnostic tool	1 hour	LGF SGF SDL	MCQS

CLASS: 2nd Year MBBS

Module No 1

1. Neurosciences Module 1A (6 weeks)

Themes for Neurosciences Module 1A

S.NO	Theme	Duration
1.	Numbness and tingling	1 week
2.	Paraplegia	1 week
3.	Syncope	1 week
4.	Hemiplegia / Aphasia	1 week
5.	Tremors	1 week
6.	Headache	1 week

Theme: Numbness and tingling

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1	**Neurotransmitters Brain and nervous tissues metabolism**	Explain the biosynthesis of different neurotransmitters	1 hour	LGF SGF SDL	MCQs
	Brain and nervous tissues metabolism	Describe the metabolism of brain and nervous tissues	1 hour	LGF SGF SDL	MCQs

THEME IV: Tremors

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1	**Phosphosphingolipids**	Describe metabolism of Phosphosphingolipids	1 hour	LGF SGF SDL	MCQs

Theme: Headache

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1	**CSF**	Describe the biochemical composition of CSF	1 hour	LGF SGF SDL	MCQs
2.	**Prostaglandins and pain**	Define Prostaglandins, Describe the role of Prostaglandins in initiation of pain.	1 hour	LGF SGF SDL	MCQs

Module No 2

2. NEUROSCIENCES IB MODULE

Themes for Neurosciences Module 1B

SNO	Theme	Duration
1.	Facial palsy (face, 5th and 7th cranial nerves)	1 week
2.	Neck swelling (thyroid, larynx, neck, muscles etc.)	1 week
3.	Cleft palate (palate, tongue, pharynx), Anosmia	1 week

4.	Diplopia / blindness (2nd, 3rd, 4th, 6th cranial nerve / eye ball / orbit)	1 week
5.	Deafness (ear / 8th nerve)	1 week

Theme: Facial palsy (face, 5th and 7th cranial nerves)

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1	**Biotechnology**	Describe the indications and procedure of Polymerase Chain Reaction (PCR), Cloning and Restriction fragment length polymorphism (RFLP)	1 hour	LGF SGF SDL	MCQs
2.	**Purine Nucleotide synthesis**	Describe the process of nucleotide synthesis	1 hour	LGF SGF SDL	MCQs
	Purine Nucleotide degradation	Describe the process of nucleotide degradation	1 hour	LGF SGF SDL	MCQs
	Hyperuricemia-Gout	Describe the normal levels of serum Uric acid in the blood. Describe the mechanism of synthesis of Uric acid from Purines. Describe the etiology, pathogenesis and clinical features of Gout.	1 hour	LGF SGF SDL	MCQs

	Salvage pathway of nucleotide synthesis	Explain the salvage pathway of Nucleotide synthesis	1 hour	LGF SGF SDL	MCQs
3.	**The structural basis of cellular information.** **DNA, chromosomes, discovery and organization in genome.**	Explain the structural basis of cellular information. Explain the structure, organization and functions of Chromosomes, DNA and genes	1 hour	LGF SGF SDL	MCQs
4	**DNA replication**	Describe the process of DNA replication	1 hour	LGF SGF SDL	MCQs
5	**Transcrition**	Describe the mechanism of transcription	1 hour	LGF SGF SDL	MCQs
6	**Protine synthesis**	Explain the mechanisms of protein synthesis	1 hour	LGF SGF SDL	MCQs
7	**Mutations**	Define mutation	1 hour	LGF SGF SDL	MCQs
8	**DNA damage and repair**	Explain the mechanisms of DNA damage and repair	1 hour	LGF SGF SDL	MCQs

Module No 3

3. GIT, Hepatobiliary and Metabolism module (9 Weeks)

Themes for GIT, Hepatobiliary and Metabolism module

S.NO	Theme	Duration
1	Painful swallowing	1 week
2	Pain Epigastrium	2 week
3	Jaundice	1 Week
4	Diarrhea and Constipation	1 Week
5	Bleeding per Rectum	1 Week
6	Glucose control (Carbohydrate metabolism)	1 Week
7	Obesity (Fat metabolism)	4 days
8	Wasting (Protein metabolism)	8 days

THEME: Painful swallowing

S.No	**Topic**	**Learning outcomes**	**Teaching hours**	**Teaching Strategy**	**Assessment Tool**
1	**Saliva**	Describe the composition of salivary secretions Describe the formation and characteristics of salivary secretions Elaborate the functions of saliva	1 hour	LGF SGF SDL	MCQs

THEME: Pain Epigastrium

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Gastric secretions**	Describe the chemical composition of gastric secretions Describe the functions of HCl and other constituents of gastric secretions Discuss the mechanism of synthesis and secretion of HCl from gastric mucosa Discuss the mechanism of secretion and role of Intrinsic factor from gastric parietal cells	2 hours	LGF SGF SDL LGF SGF SDL	MCQs MCQs

THEME: Jaundice

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Bile**	Describe the constituents of bile Describe the functions of bile Describe the mechanism of gall stone formation.	1 hour	LGF SGF SDL	MCQs

THEME: Diarrhea and Constipation

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Pancreatic secretions**	Describe the composition of pancreatic secretions Describe the mechanism of secretion and actions of pancreatic enzymes Describe the mechanism of synthesis of Bicarbonates	2 hours	LGF SGF SDL	MCQs MCQs
2.	**Digestion and absorption**	Describe the mechanism of digestion and absorption of fats in the intestines Describe the mechanism of digestion and absorption of proteins in the intestines Describe the mechanism of digestion and absorption of carbohydrates in the intestines Describe the mechanism of absorption of Iron, Vitamin-B12 and Folate in the intestines	3 hours	LGF SGF SDL	MCQs

3.	**Energy requirement of human body**	Discuss the daily energy requirement of a human body in health and disease Define BMR Enlist the causes of high and low BMR Describe the daily requirements of common vitamins, Iron, Calcium, Iodine and other minerals	1 hour	LGF SGF SDL	MCQs
4.	**Nutritional disorders**	Define Protein energy malnutrition and its associated clinical conditions	1 hour	LGF SGF SDL	MCQs
5.	**Adipose tissues**	Discuss homeostasis of adipose tissues	1 hour	LGF SGF SDL	MCQs

THEME: Bleeding Per Rectum

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Intestinal juices**	Describe the composition of intestinal juices	1 hour	LGF SGF SD	MCQs

THEME: Glucose control (Carbohydrate metabolism)

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Oxidative Phosphorylation**	Describe the generation of proton gradient & the resultant motive force across the inner mitochondrial membrane by transport of electrons through ETC which in turn produces ATP by oxidative phosphorylation Describe the structure of ATP synthase enzyme(complex-V) & explain how it works as a rotary motor to synthesize ATP from ADP & Pi	1 hour	LGF SGF SDL	MCQs MCQs
2.	**Respiratory Chain Inhibitors & Uncouples**	Describe the control of the rate of respiration, oxidation of reducing equivalents via ETC & its tightly coupling with oxidative phosphorylation in mitochondria Discuss certain common poisons	1 hour	LGF SGF SDL	MCQs MCQs MCQs

		which block respiration or oxidative phosphorylation & identify their site of action Explain how uncouplers act as poisons by dissociating oxidation from oxidative phosphorylation via ETC but at the same time they may have a physiological role in generating body heat			
3.	**Glycolysis**	Define Glycolysis Describe the entry of glucose into different kinds of cells through various GLUT transporters Describe the reactions of glycolysis	2 hours	LGF SGF SDL	MCQs
		Describe the energetics of glycolysis Describe the fates of pyruvate Describe the types of glycolysis especially the anaerobic			

		glycolysis Describe the key enzymes and regulation of glycolysis Discuss the glycolysis in RBC Describe the biomedical Significance and clinical disorders of glycolysis Discuss glycolysis in cancer cells			
4.	**Oxidation of Pyruvate**	Describe the conversion of pyruvate into acetyl CoA. Enumerate the enzymes & coenzymes of PDH complex. Describe the sequence of reactions catalyzed by PDH complex. Describe the regulation of PDH complex Discuss the clinical aspects of PDH complex especially the congenital lactic acidosis	1 hour	LGF SGF SDL	MCQs
5.	**Tricarboxylic**	Define citric acid cycle	1 hour	LGF	MCQs

	Acid Cycle	Describe the sources of acetyl CoA in mitochondria Describe the reactions of TCA Describe the energetics of TCA Discuss the energy yield of one molecule of glucose when it is converted into carbon dioxide and water Name the vitamins that play key role in TCA Describe the amphibolic nature of TCA		SGF SDL	
6.	**Gluconeogenesis**	Discuss the Cori's cycle. Discuss the regulation of Gluconeogenesis. Name the key enzymes of Gluconeogenesis.	1 hour	LGF SGF SDL	MCQs
7.	**Hexose Mono Phosphate shunt**	Discuss the Role of Pentose Phosphate Pathway Name the tissues where Hexose Mono Phosphate shunt occurs Describe the reactions	2 hours	LGF SGF SDL	MCQs

		of the two parts of Hexose Mono Phosphate shunt. Describe the Role of thiamine in Hexose Mono Phosphate shunt. Enumerate the Similarities & differences b/w glycolysis and HMP shunt pathway. Enumerate the Similarities & differences b/w glycolysis and HMP shunt pathway. Enumerate the Similarities & differences b/w glycolysis and HMP shunt pathway. Discuss the functions of NADPH (produced in Hexose Mono Phosphate shunt) in various tissues and cells. Discuss G6PD deficiency and its effects in various tissues and cells. Describe the			

		regulation of HMP shunt pathway.			
8.	**Uronic Acid Pathway**	Enumerate the products of Uronic acid pathway and their importance. Discuss why ascorbic acid is vitamin for humans.	1 hour	LGF SGF SDL	MCQs
9.	**Galactose Metabolism**	Describe the uses & requirements of galactose in the body. Discuss the various reactions with enzymes involved. Describe the Genetic Deficiencies of Enzymes in Galactose Metabolism and their effects.	1 hour	LGF SGF SDL	MCQs
10.	**Fructose Metabolism**	Describe the Main source of Fructose. Discuss the various reactions with enzymes involved. Discuss the Fructose formation in Seminal fluid. Discuss the Fructose formation in Seminal fluid Describe the mechanism of	1 hour	LGF SGF SDL	MCQs

		formation of diabetic cataract. Discuss the Defects in Fructose Metabolism and their effects.			
11.	**Glycogen Metabolism** **Glycogenesis**	Describe the structure and functions of the glycogen especially the significance of its polymer nature. Describe the Difference between Liver & muscle glycogen Describe the synthesis of glycogen by two mechanisms with its enzymes	1 hour	LGF SGF SDL	MCQs
	Glycogenolysis	Discuss. the breakdown of glycogen with its enzymes. Describe the Regulation of Glycogen metabolisms	1 hour	LGF SGF SDL	MCQs
	GSD	Discuss the glycogen storage diseases with deficient enzymes and cardinal clinical features	1 hour	LGF SGF SDL	MCQs

THEME: Obesity (Fat Metabolism)

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Fatty acid (FA) synthesis (*De Novo*)**	Enumerate the organs where fatty acid synthesis occurs with sub cellular sites. Discuss the source of Acetyl CoA that will be used for FA synthesis with reason. Discuss how acetyl CoA comes out of mitochondria for the synthesis of FA. Describe the steps of FA synthesis with enzymes. Describe the FA synthase enzyme with its structure and components. Describe the product of FA synthase and the subsequent fate of this product. Discuss the regulation of FA synthesis. Discuss why animals cannot convert fatty acids into glucose. Describe the further elongation and	1 hour	LGF SGF SDL	MCQs

		desaturation of FA and its regulation.			
2.	**Mobilization of stored fats (oxidation of FA)**	Describe how fats are mobilized from adipose tissues to the organs where they will be used for oxidation. Enumerate the various methods of oxidation of FA. Discuss the stages of beta oxidation with its reactions. Calculate the no. of ATP obtained when one molecule of palmitic acid is oxidized completely. Describe the genetic deficiencies of FA oxidation i.e. MCAD & CAT deficiencies with their hallmarks. Discuss the oxidation of odd-chain FA. Compare the processes of FA synthesis with FA oxidation.	2 hours	LGF SGF SDL	MCQs
3.	**Metabolism of Ketone bodies**	Enumerate ketone bodies. Define ketogenesis. Describe the steps of	1 hour	LGF SGF SDL	MCQs

		ketogenesis. Discuss the energy yield during ketogenesis in liver. Enumerate the conditions in which there is increased ketogenesis. Discuss utilization of ketone bodies. Discuss the energy yield in ketone bodies utilization in extra hepatic tissues. Describe the regulation of ketogenesis in well-fed healthy conditions, during early stages of starvation & in prolonged starvation. Discuss the ketoacidosis in diabetes.			
4.	**Complex Lipid metabolism**	Describe the synthesis of triacylglycerol by two mechanisms. Describe the synthesis of phosphatidic acid. Enumerate the substances formed from phosphatidic acid.	1 hour	LGF SGF SDL	MCQs
		Describe the synthesis of glycerophospholipids.	1 hour	LGF SGF	MCQs

		Discuss the degredation of glycerophospholipids. Describe the synthesis of ceramide and sphingophospholipids (shingomyelin). Discuss the degradation of shingomyelin		SDL	
		Lipid storage Diseases	1 hour	LGF SGF SDL	MCQs
5.	**Eicosanoid metabolism**	Define eicosanoids and describe their two classes. Describe the synthesis of prostanoids by cyco-oxygenase pathway. Enumerate the two isomers of cyclo-oxygenase with their inhibition. Discuss why low dose aspirin therapy is used in strokes and heart attacks. Describe biochemical reason for the adverse effects of NSAIDs & steroids. Describe the catabolism of the prostanoids. Describe the lipoxygenase pathway for	1 hour	LGF SGF SDL	MCQs

		synthesis of Leukotrienes and lipoxins. Describe the synthesis of leuktriene biosynthesis inhibition. Enumerate the leukotriene receptor antagonists			
6.	**Metabolism of cholesterol**	Describe the major sites of cholesterol synthesis as well as sub cellular sites. Describe the source of cholesterol synthesis. Describe the various steps of cholesterol synthesis. Discuss the regulation of cholesterol synthesis. Enumerate the inhibitors of HMG CoA reductase inhibitors. Describes the degradation and excretion of cholesterol with synthesis of bile acids, their conjugation, bile salt formation and micelle formation in lumen of the intestine. Discuss the enterohepatic circulation	2 hours	LGF SGF SDL	MCQs

		of bile salts. Discuss the role of bile acid sequestrants i.e. cholestyramine and dietary fibre. Discuss the regulation of bile acid synthesis			
7.	**Metabolism of lipoproteins**	Describe the structure of a typical lipoprotein particle. Enumerate the various classes of LP. Enumerate the functions of apolipoproteins. Describe the steps of chylomicrons' metabolism. Describe the metabolism of VLDL. Describe the metabolism of LDL. Describe the metabolism of HDL.	1 hour	LGF SGF SDL	MCQs
8.	**Disturbances of Lipid metabolism**	Differentiate between hyperlipidemias and dyslipidaemia. Describe the Classification of hyperlipidemias with enzyme deficiency	1 hour	LGF SGF SDL	MCQs

Theme: Wasting (Protein metabolism)

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Amino acid pool & chemical processes for dissimilation of proteins**	Discuss how amino acid pool is formed. Discuss the chemical processes responsible for dissimilation of proteins: transamination, deamination and transdeamination. Discuss the clinical importance of transaminases	1 hour	LGF SGF SDL	MCQs
2.	**Ammonia transport and effects of ammonia toxicity on brain**	Discuss how ammonia is formed in various tissues and transported to liver Discuss the effects of ammonia toxicity in brain.	1 hour	LGF SGF SDL	MCQs
3.	**Urea cycle & its associated inherited disorders**	Describe the Krebs-Henselet Cycle of Urea Formation in Liver. Describe the clinical significance of various enzymes involved in urea formation	1 hour	LGF SGF SDL	MCQs
4.	**Metabolism of aromatic amino acids**	Discuss biosynthesis, fate, metabolic functions and related inherited disorders of aromatic amino acids.	1 hour	LGF SGF SDL	MCQs
5.	**Metabolism of sulphur**	Discuss biosynthesis, fate, metabolic functions and related	1 hour	LGF SGF	MCQs

	containing amino acids	inherited disorders of sulphur containing amino acids		SDL	
6.	**Metabolism of individual amino acids**	Discuss biosynthesis, fate, metabolic functions and related inherited disorders of Glycine, serine, and alanine.	1 hour	LGF SGF SDL	MCQs
		Discuss biosynthesis, fate, metabolic functions and related inherited disorders of acidic amino acids	1 hour	LGF SGF SDL	MCQs
		Discuss biosynthesis, fate, metabolic functions and related inherited disorders of branched chain amino acids.	1 hour	LGF SGF SDL	MCQs

LAB WORK

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Determination of plasma proteins**	Estimate the plasma proteins in a given blood sample	1.5 hour	Practical Demonstration Performance	OSPE Viva Practical notebook
2.	**Determination of free, total and combined acidity of the Gastric juice**	Estimate free, total and combined acidity of gastric juice	1.5 hour	Practical Demonstration Performance	OSPE Viva Practical notebook
3.	**Determination**	Estimate serum	1.5 hour	Practical	OSPE

	of serum Bilirubin	Bilirubin in a given blood sample		Demonstration Performance	Viva Practical notebook
4.	**Determination of Titrable acidity of urine**	Estimate the Titrable acidity of urine	1.5 hour	Practical Demonstration Performance	OSPE Viva Practical notebook

Module No 4

RENAL MODULE (3 week)

Themes for RENAL MODULE

S.NO	Theme	Duration
1.	Flank pain/Loin pain	1 week
2.	Scanty urine/Urinary retention and Edema	1 week
3.	Urinary incontinence	1 Week

THEME: Flank pain/Loin pain

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Acid base balance and imbalance**	Study the sources of Hydrogen Ion, pH & Anion Gap Describe Buffer Systems operating in the Body Carbonic acid,protein,and phosphate buffer Transporting acid and mitigating pH changes.	1 hour	LGF SGF SDL	MCQs
		Describe Respiratory Regulation of Acid Base Balance	1 hour	LGF SGF SDL	MCQs
		Describe Disorders of Acid Base Balance: their causes, mechanisms and compensations of Respiratory Acidosis & Alkalosis and Metabolic Acidosis & Alkalosis	1 hour	LGF SGF SDL	MCQs

LAB WORK

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Titrable acidity of Urine**	Find out PH of urine	1.5 hours	Practical Demonstration Performance	OSPE Viva Practical note book

Theme: Edema and Urinary retention/ Scanty Urine

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Renal control of Calcium & Phosphorus**	State the normal total plasma calcium concentration and the fraction that is free Describe the distribution of calcium between bone and extracellular fluid and the role of bone in regulating extracellular calcium. Describe renal handling of phosphate. Describe how parathyroid hormone changes renal phosphate excretion.	1 hour	LGF SGF SDL	MCQs
		Describe and compare osteocytes osteolysis and bone remodelling .	1 hour	LGF SGF SDL	MCQs
2.	**Constituents of urine**	Describe the normal and abnormal constituents of urine .	1 hour	LGF SGF SDL	MCQs

LAB WORK:

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Urine analysis**	Determine the normal/abnormal constituents in the urine -Urine sugar -Amino acids -Proteins -Hemoglobin -Uric acid -Urea -Creatinine and chloride -Calcium and phosphate,-Ammonia -Ketone bodies -Benzidine test for blood in urine	1.5 hours	Practical Demonstration Performance	OSPE Viva Practical notebook

Theme: Urinary incontinence

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Water balance/metabolism**	Mechanism & regulation of Water balance Disorders of water balance, such as dehydration & over hydration	1 hour	LGF SGF SDL	MCQs
		Electrolytes (intracellular & extracellular cations) & its metabolism Disorders of electrolyte metabolism	1 hour	LGF SGF SDL	MCQs

LAB WORK

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Creatinine in urine**	Estimation of creatinine in 24 hour urine sample	1.5 hours	Practical Demonstration/ Performance	OSPE Viva Practical notebook

Module No 5

5. ENDOCRINE MODULE

Themes for Endocrine module

S.NO	Theme	Duration
1	Tall stature	1 week
2	Neck swelling with bulging eyes/tetany	1 week
3	Increased thirst and urination	1 Week
4	Moon face	4 days

Theme: Tall stature

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1.	**Hormones Introduction**	Define hormones and differentiate between the terms- endocrine, paracrine & autocrine Classify hormones on various basis	1 hour	LGF SGF SDL	MCQs
		Discuss the mechanisms of action of hormones. Define 2nd messengers and their roles.	1 hour	LGF SGF SDL	MCQs
2.	**Anterior Pituitary hormones**	Enumerate the hormones of anterior pituitary gland. Describe the chemistry, secretion, mechanism of action, regulation and metabolic effects of Growth hormone with its related clinical disorders.			
3.	**Posterior Pituitary hormones**	Enumerate the hormones of the posterior pituitary gland Describe the chemistry, secretion, mechanism of	1 hour	LGF SGF SDL	MCQs

		action, regulation and metabolic effects of the hormones of the posterior pituitary gland with its related clinical disorders .			

Theme: (Neck swelling with bulging eyes and Tetany)

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Thyroid gland**	Enumerate the hormones secreted from thyroid gland. Describe the chemistry, biosynthesis, secretion, mechanism of action, regulation and metabolic effects of thyroid hormone and its clinical disorders	1 hour	LGF SGF SDL	MCQs
		Describe the chemistry, biosynthesis, secretion, mechanism of action, regulation and metabolic effects of calcitonin with its related clinical disorders.	1 hour	LGF SGF SDL	MCQs
2.	**Parathyroid gland**	Enumerate the hormones secreted from parathyroid gland. Describe the chemistry, biosynthesis, secretion, mechanism of action, regulation and metabolic effects of parathyroid hormone with its related clinical disorders.			

Theme: (Increased thirst and urination)

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Pancreas**	Enumerate the hormones secreted by pancreas. Describe the chemistry, biosynthesis, secretion, mechanism of action, regulation and metabolic effects of Insulin with its related clinical disorders	1 hour	LGF SGF SDL	MCQs
		Describe the chemistry, biosynthesis, secretion, mechanism of action, regulation and metabolic effects of Glucagon with its related clinical disorders.	1 hour	LGF SGF SDL	MCQs

Theme: (Moon face)

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Adrenal cortical hormones**	Enumerate the hormones secreted from adrenal cortex. Describe biosynthesis, secretion, mechanism of action, regulation and metabolic effects of Adrenal cortical hormones with its related clinical disorders I.	1 hour	LGF SGF SDL	MCQs
		Describe biosynthesis, secretion, mechanism of action, regulation and metabolic effects of Adrenal cortical hormones with its related clinical disorders II.	1 hour	LGF SGF SDL	MCQs
2.	**Adrenal medullary hormones**	Enumerate the hormones secreted from adrenal medulla. Describe biosynthesis,			

		secretion, mechanism of action, regulation and metabolic effects of Adrenal medullary hormones with its related clinical disorders. Describe the structure and functions of Melanocyte-Stimulating Hormone, Lipotropin, and Endorphins.			

LAB WORK:

S.No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Urinary glucose**	Detect glucose in urine	1.5 hours	Practical Demonstration/ Performance	OSPE Viva Practical notebook
2.	**Blood glucose**	Detect glucose in blood	1.5 hours	Practical Demonstration/ Performance	OSPE Viva Practical notebook
3.	**Glucose tolerance test**	Perform and interpret Glucose tolerance test	1.5 hours	Practical Demonstration/ Performance	OSPE Viva Practical notebook

Module No 6

6. REPRODUCTION MODULE

Themes for Reproduction module (3 weeks)

S.NO	Theme	Duration
1	Pregnancy and child birth	2 week
2	Infertility	1 week

Theme: Infertility

S. No	Topic	Learning outcomes	Teaching hours	Teaching Strategy	Assessment Tool
1	**Sex hormones Testosterone**	Discuss the chemistry, synthesis, enzyme deficiency, mechanism of action, receptors, classical and non-classical target Organs, metabolic functions, manifestations of deficiency and Excess, of testosterone hormones	1 hour	LGF SGF SDL	MCQs
2.	**Estrogen**	Discuss the chemistry, synthesis, enzyme deficiency, mechanism of action, receptors, classical and non-classical target Organs, metabolic functions, manifestations of deficiency and excess of estrogens hormones	1 hour	LGF SGF SDL	MCQs
3.	**Progesterone**	Discuss the chemistry, synthesis, enzyme deficiency, mechanism of action. Receptors, classical and non-classical target Organs, metabolic functions, manifestations of	1 hour	LGF SGF SDL	MCQs

		deficiency and excess of progesterone hormones			
4.	**FSH and LH**	Discuss the chemistry, synthesis, enzyme deficiency, mechanism of action. Receptors, classical and non-classical target Organs, metabolic functions, manifestations of deficiency and excess of FSH and LH.ormone HCG h	1 hour	LGF SGF SDL	MCQs
5.	**Menopause**	Menstrual cycle, Menopause,	1 hour	LGF SGF SDL	MCQs

CLASS: 3rd Year MBBS

Module No 1

1. CVS and Respiration module

Theme: Numbness and tingling

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1	**Lipoprotein and Cholesterol**	Claasify and describe types of proteins, Summarize cholesterol synthesis.	1 hour	LGF SGF SDL	MCQs

CLASS: 4th Year MBBS

1. Module Renal

Theme: Numbness and tingling

S.No	Topic	Learning outcomes	Teaching Hours	Teaching Strategy	Assessment Tool
1	**Acid base balance and disorders**	Describe and classify Acid base balance and disorders.	1 hour	LGF SGF SDL	MCQs

Learning Resources:

S.No	Text/Reference Books	Edition
1.	Harper's Illustrated Biochemistry by Murrary RK, Granner DK and Rodwell VW	Latest edition
2.	Lippincott's Illustrated Reviews: Biochemistry by Harvey R and Ferrier D, Latest edition published by Lippincott Williams & Wilkins	Latest edition
3.	Marks' Basic Medical Biochemistry — A Clinical Approach, by Smith C, Marks AD, and	Latest edition
4.	Lehninger Principles of Biochemistry by David L Nelson and Michael M. Cox	Latest edition
5.	Tietz Textbook of Clinical Chemistry by Burtis CA and Ashwood ER published by Saunders.	Latest edition

Additional Learning Resources:

Videos	**Best Biochemistry youtube channel**
Internet Resources	Introduction to Biochemistry

ASSESSMENT METHODS

- **MCQs**: **Multiple Choice questions;** Single best Type
- **OSPE/OSCE**: Objective Structured Practicall Examination
- **Presentations**
- **CBL**

Multiple Choice Questions:

1. Single best type MCQs having five options with one correct answer and four distractors are part of assessment.
2. Correct answer carries one mark, and incorrect will be marked zero. Rule of negative marking is not applicable.
3. Students mark their responses on specified computer-based designed sheet.

Objective Structured Practical/Clinical Examination

1. OSPE/OSCE stations are used for formative as well as summative assessment.
2. Time allocated for each station is five minutes as per Examination rules ofKhyber Medical University, Peshawar.
3. All students are rotated through the same stations.
4. Stations used are unobserved, observed, interactive and rest stations.
5. On unobserved stations, models, lab reports, radiographs, flowcharts, case scenarios may be used to assess cognitive domain.
6. On observed station, examiners don't interact with candidate and just observe the performance of skills /procedures.
7. On interactive station, examiner ask questions related to the task within the allocated time.
8. On rest station, students are not given any task. They just wait to move to the next station.

Presentation:
Students are given topics for presentation either individually or in groups. They are encouraged to prepare presentations on power point to enhance their understanding of the topic.

CBL:
CBLs are practiced during SGF by providing scenarios based questions on topics already taught during LGFs and SGFs.

Internal Assessment Criteria:
1st Year MBBS: Paper A: 14, Paper B: 13,,Paper C: 13

2nd Year MBBS: Paper D: 14, Paper E: 13, Paper F: 13

This Internal Assessment will comprise of following components

a) Attendance
b) Block Examination Results
c) Practical notebooks

Examination Rules & Regulations:

1. Exam Cell conducts the End of Module and Block Assessments according to the blueprint provided by the Khyber Medical University, marks of which will be included in internal assessment.

2. The minimum passing marks in each subject shall be 50% in theory and practical. A student who fails in theory or practical examination of a subject shall be considered to have failed in the subject.

3. No student is eligible for university examination without attending at least 75% of lecturers, demonstrations, tutorials, and practical/clinical work in both in-patient and out-patient departments in that academic session.

Feedback on Examination:

1. Students' feedback on assessment strategies will be taken in a preformedproforma for feedback at the end of the session.
2. Department of Medical Education & Quality Enhancement Cell in collaboration with Exam Cell of WDC is responsible to conduct this exercise.

QUESTIONS:

MULTIPLE CHOICE QUESTION

MCQ

1. The hormone which is derivative of an amino acid is

a. Androgens

b. Estrogens

c. Epinephrine

d. Insulin

e. Parathormone

SUGGESTIONS FOR NEXT ACADEMIC YEAR:

- For paper D of 2nd year MBBS, number of MCQs should be according to the syllabus.
- SEQs should be added to the assessment methods.

PREPARED BY:

Prof Dr Uzma Faryal,

HOD Biochemistry Department,

Women Medical College,

Abbottabad.