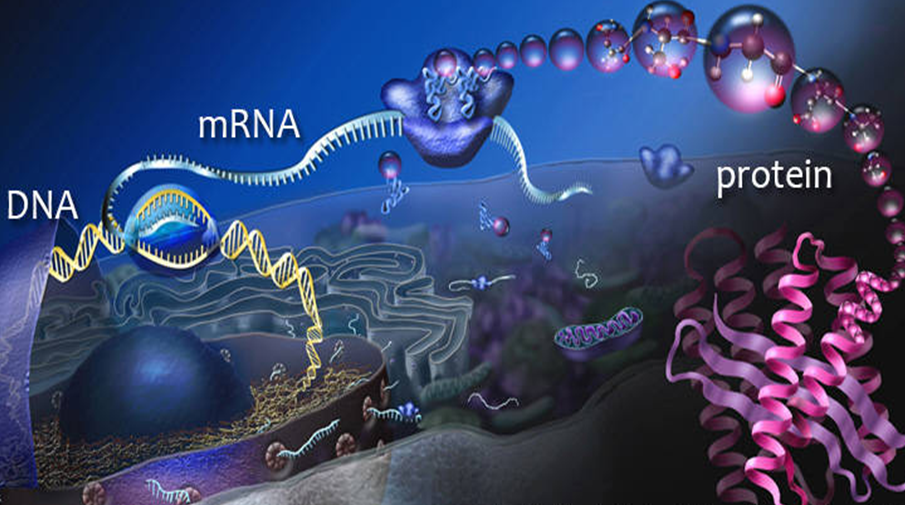


STUDY GUIDE

DEPARTMENT OF BIOCHEMISTRY

SECOND YEAR MBBS

2023



LAHORE MEDICAL AND DENTAL COLLEGE

**Mission of LMDC**

The Lahore Medical & Dental College is committed in its pursuit of excellence to providing the best academic facilities and atmosphere to its students.

Our mission is to “Train future leaders of medicine who set new standards in knowledge, care, and compassion”.

The well qualified and committed faculty of LMDC provides combination of nurturing support and challenge to the students to reach their maximum potential.

LMDC, LHR

**DEPARTMENTAL ORGANOGRAM/HIERARCHY**

**HEAD OF DEPARTMENT**

**Prof. Dr. Rubina Bashir**

**PROFESSOR: Dr. Sobia Imtiaz**

**ASSOCIATE PROFESSOR: Dr. Naveed Shuja**

DEMONSTRATOR

Dr. Aadil Rehman

DEMONSTRATOR

Dr. Abdullah Najam

**ASSISTANT PROFESSOR: Dr. Mahwish Shahzad**

**ASSISTANT PROFESSOR: Dr. Khaulah**

DEMONSTRATOR

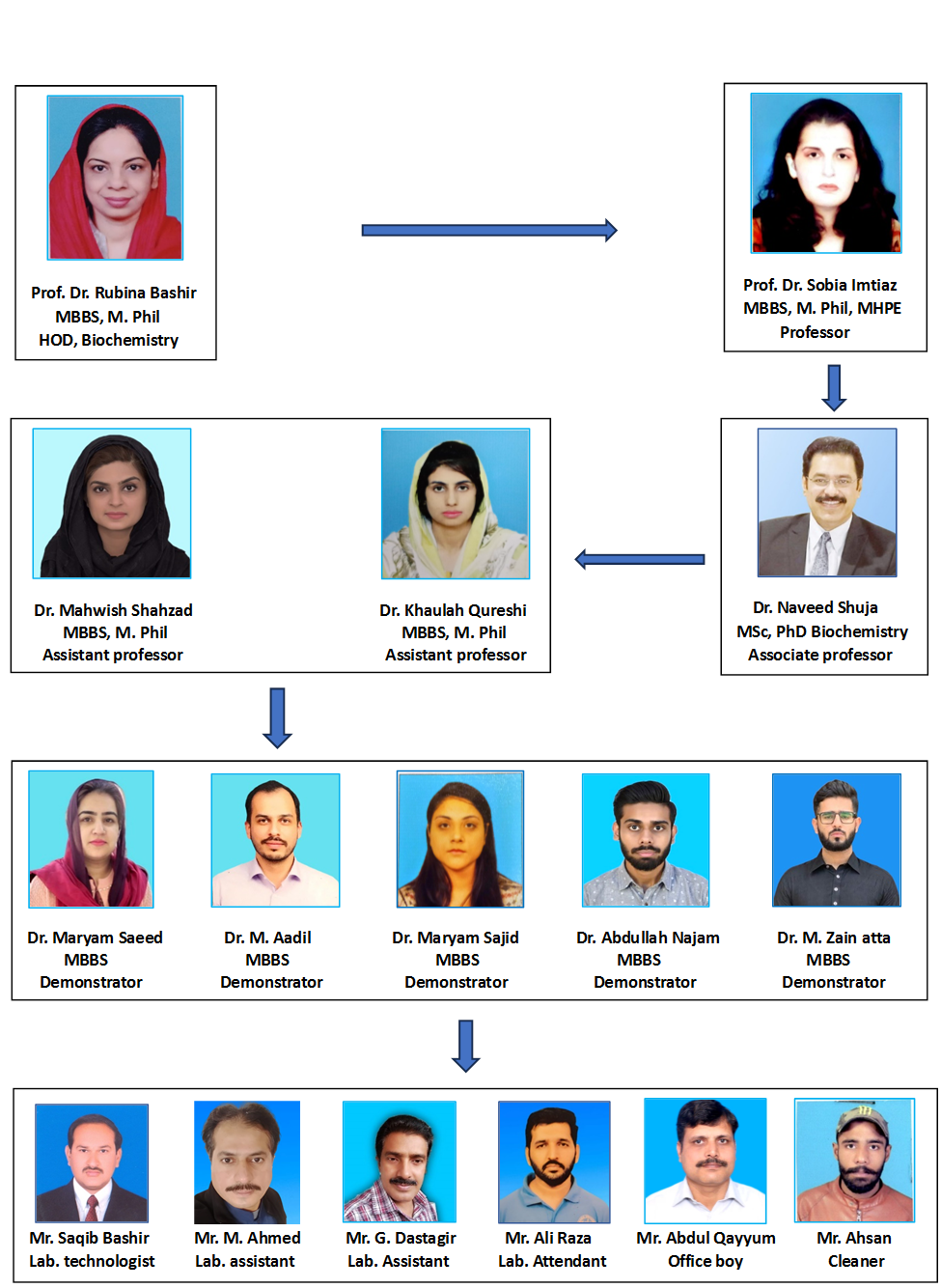
Dr. Maryam Sajid

DEMONSTRATOR

Dr. Maryam Saeed

DEMONSTRATOR

Dr. M. Zain Atta

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**I. INTRODUCTION/RATIONALE OF THE SUBJECT**

**Level of students:** Second year MBBS

**Duration of session:** 30th Jan 2023- 13th Oct 2023

**II. LEARNING OUTCOMES OF THE SUBJECT**

At the end of the Part-II course, the student should be able to demonstrate his\her knowledge and understanding on the subject with following learning objectives

1. To be familiar with the homeostatic mechanisms through the concepts of inter-regulation of carbohydrates, lipids and protein metabolism and its relation to hormone actions in the human body.
2. Once these basic concepts are understood, it will be straightforward to understand how alterations in the basic processes can lead to a disease state.
3. To have understanding and knowledge about many pathological situations where these can be related to biochemical defects and to have some experience of biochemical techniques in order to understand the practical/clinical problems in biochemistry.
4. To develop skills as a self-directed learner, recognize continuing educational needs; use appropriate learning resources and critically analyze relevant literature in order to have a comprehensive understanding and knowledge of biochemistry.
5. To learn and understand the basic biochemical processes taking place in the body, since these underline an understanding of normal and abnormal human metabolism. In order to accomplish this, the student should learn how large molecules are synthesized and used (DNA, RNA, and proteins), and how energy is generated, stored, and retrieved (metabolism).
6. To describe digestion assimilation of nutrients & consequences of malnutrition. Integrate the various aspects of metabolism & their regulatory pathways.
7. To explain biochemical basis of inherited disorders with their associated sequelae.
8. To outline the molecular mechanisms of gene expression, the principles of genetic engineering & their applications in medicine.
9. To outline the biochemical basis of cancer & carcinogenesis.
10. To make use of conventional techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis. Familiarize with principles of various conventional & specialized lab investigations & instrumentation analysis & interpretation of a given data.
11. Applying basic knowledge of protein synthesis, post translational modification and targeting to its cellular destination.
12. Principles of various conventional and specialized laboratory investigations and instrumentation, analysis and interpretation of a given data; the ability to suggest experiments to support theoretical concepts and clinical diagnosis

**III. UHS SYLLABUS\ CONTENTS**

1- Bioenergetics and Biologic Oxidation

1. Endergonic and exergonic reactions, free energy, free energy change, ATP and other compounds as carriers of energy
2. Electron transport chain: Components and organization of electron transport chain (ETC)
3. Reactions of electron transport chain, redox potential, methods of electron transfer among the components of electron transport chain, and energy release during electron transport
4. Oxidative phosphorylation: ATP synthesis in ETC, inhibitors and uncouplers of oxidative phosphorylation, and chemiosmotic hypothesis of oxidative phosphorylation

2- Metabolism of Carbohydrates

a) Glycolysis

* Reactions of aerobic and anaerobic glycolysis occurring in RBCs and other tissues
* Biomedical significance and energy yield of aerobic and anaerobic glycolysis and its significance, and substrate-level phosphorylation
* Regulation of glycolytic pathway
* Metabolic fates of pyruvate
* Lactic acidosis; genetic deficiency of pyruvate kinase and pyruvate dehydrogenase

b) Tricarboxylic acid (TCA) cycle

* Reactions of TCA cycle and their regulation along with energy yield
* Importance of TCA cycle and its amphibolic role

c) Gluconeogenesis

* Reactions of gluconeogenesis using pyruvate and glycerol as precursors, and regulation of gluconeogenesis
* Important gluconeogenic precursors: Entrance of amino acids, intermediates of TCA cycle, glycerol, and other compounds as gluconeogenic precursors
* Biomedical significance of gluconeogenesis: Role of gluconeogenesis in plasma glucose level regulation, and the Cori cycle, and glucose-alanine cycle.

d) Glycogen metabolism

* Synthesis and importance of UDP glucose
* Reactions of glycogenesis and glycogenolysis
* Regulation of glycogen synthase and glycogen phosphorylase
* Importance of allosteric regulation of glycogen phosphorylase ‘a’ (a plasma glucose sensor) by plasma glucose
* Disorders of glycogen metabolism (glycogen storage diseases)

e) The hexose monophosphate pathway and other pathways of hexose metabolism

* Hexose monophosphate (HMP) pathway: Reactions of oxidative and non-oxidative phases of HMP pathway, importance of HMP pathway along with uses of NADPH, and glucose 6-phosphate dehydrogenase deficiency
* Reactions of uronic acid pathway along with its biologic importance
* Metabolism of fructose: Metabolic fate of fructose in human body, sorbitol metabolism along with effect of hyperglycemia on sorbitol metabolism, essential fructosuria and hereditary fructose intolerance
* Metabolism of galactose: Metabolic fate of galactose in body and synthesis of lactose; and disorders of galactose metabolism (galactokinase deficiency and classic galactosemia)
* Metabolism of ethanol

f) Regulation of blood glucose level

* Regulation of plasma glucose hormonally (insulin, glucagon, growth hormone, epinephrine, and cortisol) and non-hormonally, and the role of various metabolic pathways in blood glucose level regulation
* Hypoglycemia and hyperglycemia: An overview of hypoglycemia and hyperglycemia, their important causes, and clinical manifestations
* Diabetes mellitus: Types of diabetes mellitus along with its clinical manifestations, metabolic changes in type 1 and type 2 diabetes mellitus, and diagnosis of diabetes mellitus

3-Metabolism of lipids

1. de novo synthesis of fatty acids: Production of cytosolic acetyl CoA, fatty acid synthase multienzyme complex, reactions of cytosolic fatty acid synthesis, elongation of fatty acid chain, synthesis of polyunsaturated fatty acid, and regulation of fatty acid synthesis
2. Synthesis and storage of triacylglycerols in body
3. Mobilization of stored triacylglycerols along with its regulation
4. Oxidation of fatty acids: Activation of fatty acid, translocation of fatty acyl CoA into mitochondrial matrix, reactions of β-oxidation of saturated and unsaturated fatty acids, energy yield of β-oxidation, fate of acetyl CoA, and other types of fatty acid oxidation (alpha-oxidation, omega-oxidation, and oxidation of odd-carbon fatty acids)
5. Synthesis and utilization of ketone bodies: Reactions of hepatic ketogenesis, and utilization of ketone bodies by extra hepatic tissues
6. Ketoacidosis and regulation of ketogenesis
7. Synthesis of eicosanoids, their regulation, and functions along with their biomedical importance
8. Metabolism of phospholipids and sphingolipids: Synthesis of phospholipids (Phosphatidylcholine and Phosphatidylethanolamine), synthesis of glycerol ether phospholipids (Cardiolipin and platelet activating factor), degradation of phospholipids, deficiency of lung surfactant, metabolism of glycolipids, biosynthesis of Ceramide, sphingomyelin, and gangliosides, and degradation of sphingolipids along with sphingolipidoses
9. Cholesterol metabolism: Reactions and regulation of cholesterol biosynthesis, and fate and functions of cholesterol in body
10. Biosynthesis and fate of bile acids and their significance in health and disease
11. Plasma lipoproteins: Synthesis, transport, and fate of chylomicrons, VLDL, IDL, LDL, and HDL; disorders associated with impairment of lipoprotein metabolism, and atherogenic effect of oxidized LDL
12. Biochemical defects leading to fatty liver

4- Metabolism of Proteins and Amino Acids

1. An overview of protein turnover in human body; nitrogen balance (positive and negative)
2. Inter-organ amino acid exchange in normal post-absorptive state
3. Degradation of amino acids; removal of nitrogen from amino acids by transamination and deamination; sources of ammonia in body; transport of ammonia, ammonia toxicity; fate of ammonia in body, reactions, and regulation of the urea cycle along with metabolic disorders of the urea cycle
4. An overview of amphibolic intermediates formed from the carbon skeleton of amino acids
5. Concept of glucogenic and ketogenic amino acids; an outline of the metabolism of individual amino acids like glycine, cysteine, arginine, proline, phenylalanine, tyrosine, histidine, tryptophan, methionine amino acids; causes and salient features of important metabolic defects in amino acid metabolism like phenylketonuria, maple syrup urine disease (MSUD), histidinemia, alkaptonuria, cystathioninuria, homocystinuria, hyperprolinemia, cystinuria, cystinosis, tyrosinemias, and albinism
6. Metabolism of epinephrine and norepinephrine, creatine, creatinine, histamine, gamma-amino butyrate, serotonin, melatonin, and melanin

5- Integration and Regulation of Metabolic Pathways

1. Fed-fast cycle and starvation
2. Basic concepts of intermediary metabolism, introduction of anabolic and catabolic pathways
3. An overview of regulation and integration of various metabolic pathways (role of liver, heart, brain, skeletal muscle, and adipose tissue)

6- Metabolism of Nucleotides

1. De novo Synthesis of purines and pyrimidines; the salvage pathways of nucleotide synthesis; degradation of purine and pyrimidine nucleotides
2. Disorders associated with purine nucleotide metabolism like adenosine deaminase deficiency, purine nucleoside phosphorylase deficiency, and hyperuricemia
3. Natural and synthetic derivatives of purines and pyrimidines and their role in health and disease

7- Biochemical Genetics (Informational Flow in the Cell)

1. The structural basis of cellular information
2. Organization of DNA: chromosomes, Karyotyping.
3. Replication of DNA: Reactions of DNA replication in eukaryotes and prokaryotes; types of damage to DNA and DNA repair; mutations
4. Transcription (DNA-dependent RNA synthesis): Steps in the transcription of eukaryotic and prokaryotic genes; post-transcriptional modifications (processing) of RNA; reverse transcription in retroviruses and its relation to cancers and AIDS
5. Translation (protein synthesis): The genetic code; components required for protein synthesis, composition of eukaryotic and prokaryotic ribosomes; steps of protein synthesis; post-translational modifications of polypeptide chains; protein targeting
6. Regulation of gene expression in prokaryotes and eukaryotes
7. Molecular biology techniques: Basic information and biomedical importance of molecular biology techniques; DNA extraction; recombinant DNA technology; DNA cloning; polymerase chain reaction (PCR); hybridization; blotting techniques
8. Oncogenes and their role in carcinogenesis; mechanisms of activation of proto-oncogenes; mechanism of action of oncogenes; tumor suppressor genes and oncogenic viruses
9. Genetic basis of disease
10. Important tumor markers and their clinical significance (Carcinoembryonic Antigen, Alpha fetoprotein, human chorionic gonadotropin, calcitonin, and prostatic acid phosphatase)

8- Biochemistry of Endocrine System

1. An overview of endocrine system; classification of hormones based on their mechanism of action and chemical nature; mechanisms of action of each class of hormone; general characteristics of various types of hormone receptors; types and actions of various kinds of G-proteins in mediating the actions of hormones; signal transduction pathways of various hormones; types and role of various kinds of second messengers
2. Pituitary and hypothalamic hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all hypothalamic and pituitary hormones; disorders associated with hyper- and hypo-activities of these hormones such as growth hormone deficiency (dwarfism), gigantism, acromegaly, Cushing’s syndrome, Addison’s disease, Diabetes insipidus, and the inappropriate secretion of ADH (SIADH)
3. Thyroid Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all thyroid hormones; disorders associated with hyper- and hypo-activities of these hormones like goiter, hypothyroidism, hyperthyroidism, Graves’ disease
4. Calcium Regulating Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of parathyroid hormone; disorders associated with hyper- and hypo-activities of these hormones like; role of parathyroid hormone, calcitriol, and calcitonin in calcium homeostasis; hypoparathyroidism, hyperparathyroidism (primary, secondary, and tertiary), pseudohypoparathyroidism, rickets, and osteomalacia)
5. Adrenal Cortical Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all adrenal cortical hormones; disorders associated with hyper- and hypo-activities of these hormones like Cushing’s disease / syndrome, secondary adrenal deficiency, Addison’s disease, primary aldosteronism and secondary aldosteronism
6. Adrenal Medullary Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all adrenal medullary hormones; and associated disorders like Pheochromocytoma
7. Male and Female Gonadal Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all male and female gonadal hormones; disorders associated with hyper- and hypo-activities of these hormones like; hypergonadism and hypogonadism in males and females
8. Hormones of Pancreas: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all pancreatic hormones (insulin, glucagon, somatostatin, and pancreatic polypeptide); disorders associated with hyper- and hypo-activities of these hormones like; pathophysiology of insulin deficiency and diabetes mellitus

9- Biochemistry of Digestive Tract

1. Introduction, chemical composition, and secretion and regulation of various digestive juices of GIT such as saliva, gastric juice & HCl, pancreatic juice, bile, and succus entericus
2. Hydrolysis (digestion) of carbohydrates, lipids, proteins, and nucleic acids in gastrointestinal tract
3. Absorption of carbohydrates, lipids, and amino acids
4. Disease states associated with GIT disorders like achlorhydria, peptic ulcers, lactose intolerance, cholelithiasis and pernicious anemia, cystic fibrosis, and celiac disease
5. Site of synthesis and major actions of gastrointestinal hormones like gastrin, cholecystokinin (CCK), secretin, gastric inhibitory peptide (GIP), vasoactive intestinal polypeptide (VIP), motilin, enkephalins, substance P, neurotensin, and enteroglucagon

10- Metabolism of Xenobiotics

1. Definition and classes of important xenobiotics of medical relevance, their phases of metabolism and clinical significance (Cytochrome P450: Cytochrome P450 hydroxylase cycle in microsomes; role of cytochrome P450 in phase I metabolism of xenobiotics; induction of cytochrome P450)
2. Phase II metabolism of xenobiotics; types of phase II reactions
3. Responses to xenobiotics including pharmacologic, toxic, immunologic, and carcinogenic effects

11- Water & electrolyte balance; acid-base regulation

1. Biochemical mechanisms to regulate water and electrolyte balance in body: Fluid compartments of the body; gain and loss of body water; regulation of body water balance, effect of pure water deprivation, water excess or water intoxication; and electrolytes of body fluids (sodium, potassium, magnesium, and chloride)
2. Body buffer systems, role of lung and kidney in maintenance of acid-base balance
3. Acid-base disturbance in the body like respiratory and metabolic acidosis (lactic acidosis and ketoacidosis); respiratory and metabolic alkalosis; concept of anion gap, base excess and base deficit
4. Clinical interpretation of laboratory report of arterial blood gases

**Laboratory Experiments**

* The introduction of techniques and instrumentation of clinical biochemistry like centrifugation, spectrophotometry (visible, UV, infra-red and atomic absorption), pH metry, chromatography, electrophoresis, enzyme-linked immunosorbent assay (ELISA), micro pipetting, flame photometry and ion selective electrode (ISE) technique
* Collection, preservation, and storage of blood sample
* Estimation of various substances in blood and other biological fluids, like glucose, creatinine, urea, protein, albumin, uric acid, and calcium, total cholesterol; HDL cholesterol, and triacylglycerols; demonstration of creatinine clearance; and oral glucose tolerance test (OGTT)
* Determination of plasma enzyme activities of alanine aminotransferase (ALT), aspartate aminotransferase (AST), amylase, creatine phosphokinase (CK), alkaline phosophatase (ALP), and lactate dehydryogenase (LDH)
* Clinical interpretation of common laboratory values of the compounds and enzymes as listed above
* Determination of amino acids in urine by paper chromatography (demonstration)

**IV. TEACHING AND LEARNING METHODOLOGIES (INSTRUCTIONAL STRATEGIES)**

1. Large group teaching strategies

* Lectures
* Interactive sessions

1. Small group teaching strategies:

* Employed during practicals (weekly) and tutorials (weekly)
* Interactive sessions
* Small group discussions (SGDs)
* Take home assignments
* SEQ and MCQ exercises
* Viva voce
* Presentations by students
* Laboratory demonstrations and practicals

1. Integrated teaching strategies

* Horizontal integration is being achieved by aligning teaching of biochemistry course with that of anatomy and physiology
* Vertical integration is being achieved by regular clinico-biochemical conferences (CBCs) and hospital visits

**V. LEARNING RESOURCES**

1. **Recommended text books**

* Harper’s Illustrated Biochemistry by Murrary RK, Granner DK and Rodwell VW, latest edition, McGraw Hill
* Lippincott’s Illustrated Reviews: Biochemistry by Harvey R and Ferrier D, Latest edition, published by Lippincott Williams & Wilkins
* Marks’ Basic Medical Biochemistry – A Clinical Approach, by Smith C, Marks AD, and Lieberman M. Latest edition, published by Lippincott Williams & Wilkins
* Practicals and Viva in Medical Biochemistry by Dandekar SP and Rane SA, latest edition, published by Elsevier.

1. **Reference books**

* Textbook of Biochemistry with Clinical Correlations by Devlin TM, latest edition, published by Wiley-Liss
* Biochemistry by Berg JM, Tymoczko JL, and Stryer L, latest edition, published by W.H. Freeman and Company
* Lehninger Principles of Biochemistry by David L Nelson and Michael M. Cox
* Tietz Textbook of Clinical Chemistry by Burtis CA and Ashwood ER published by Saunders.
* Fundamentals of Biochemistry Life at Molecular Level by Donald Voet, Judith G Voet and Charlotte W. Pratt
* Biochemistry by Berg JM, Tymoczko JL, and Stryer L, latest edition, published by W.H. Freeman and Company
* Tietz Textbook of Clinical Chemistry by Burtis CA and Ashwood ER published by Saunders.
* Clinical Chemistry and Metabolic Medicine by Martin A. Crook, latest edition, Edward Arnold (Publishers) Ltd
* Practicals and Viva in Medical Biochemistry by Dandekar SP and Rane SA, latest edition, published by Elsevier

1. **Lecture hand-outs**
2. **Practical note book**

**VI. ASSESSMENT METHODS**

All assessments are meticulously planned in collaboration with other concerned departments to avoid clustering/overlapping and schedule is placed on the departmental notice board specified for each class at the beginning of session. At least one biochemistry test is conducted each month. Topics included in each test are notified and resources are identified.

1. Written tests

Written class tests include MCQs (one best type) and SEQs. Approximately25% of questions are clinically oriented. University recommendations for marks distribution are strictly followed.

1. Oral examination

In order to prepare the students for the oral component of university examination, viva voce examinations (by senior faculty members) are also conducted during the session.

1. Send up examination

Send up is a comprehensive examination including whole biochemistry course that is conducted at the end of academic session and final university examination pattern is followed in every respect (no. of questions, ToS, marks distribution, total time allowed etc.).

1. OSPE & viva voce

At least one OSPE & viva voce test is conducted during the session.

1. Pre-test quizzes

Pre-test quizzes on clinically relevant topics are introduced during 2019.

**VII. FORMATIVE AND SUMMATIVE EXAM RULES AND REGULATIONS**

**RULES AND REGULATIONS FOR FORMATIVE ASSESSMENTS:**

A total number of seven class tests including mid-term are planned during the session and pass percentage will be 50%. Only the students with valid reasons will be allowed re-take. A comprehensive send-up examination will be held at the end of session. Students are required to pass 50% class tests in order to appear in annual UHS examination. Supplementary holders must start attending classes from the next day after completion of the said exam. Supplementary holders after passing their exam will be allowed to appear in next year’s annual exams only if they fulfill UHS criteria of 75% attendance and 50% class tests passed by the end of respective year or 90% attendance and 75% class tests passed during post supplementary period.

The detained students will not be allowed to sit in the next annual exams unless they have attended 90% of regular classes during post detention period in the subject they are detained and 75% class tests passed after declaration of supplementary result till the end of session. If they fail to meet the said requirement, they will be considered ineligible to appear in the upcoming annual university examination and will appear in next supplementary exam after fulfilling the requirements.

**RULES AND REGULATIONS FOR SUMMATIVE ASSESSMENTS:**

**UHS Statutes & Regulations for Second Professional M.B.B.S. Examination**

**STATUTES**

1. The Second Professional Examination shall be held at the end of second year MBBS class.
2. Every candidate shall be required to study subjects of Anatomy (including Histology), Physiology, Biochemistry and Behavioural Sciences.
3. Every candidate shall take the examination in following subjects in Second Professional MBBS Examination:-
4. Anatomy (including Histology) - 200 Marks
5. Physiology - 200 Marks
6. Biochemistry - 200 Marks

**C. Biochemistry**

The examination in the subject of Biochemistry shall be as follows:-

I. One written paper of 90 marks in Biochemistry having two parts:

i. Part I shall have forty five Multiple Choice Questions (MCQs) of 45 marks and the time allotted shall be forty five minutes.

ii. Part II shall have 9 Short Essay Questions (SEQs) of 45 marks and the time allotted shall be two hours and fifteen minutes.

II. Oral and Practical examination shall have 90 marks.

III. The continuous internal assessment shall carry 20 marks i.e. 10% of the total allocated marks for the subject. The score will be equally distributed to the Theory and Practical Examinations.

1. The medium of Examinations shall be English.
2. No grace marks should be allowed in any examination or practical under any guise or name.

**Table of specifications for Biochemistry Theory paper**

**MBBS second professional examination**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Contents** | **SEQs** | **MCQs** |
| 1 | Bioenergetics and biologic oxidation | 0.5 | 2 |
| 2 | Carbohydrate Metabolism | 1.5 | 6 |
| 3 | Lipid Metabolism | 1.5 | 6 |
| 4 | Metabolism of proteins and amino acids | 1.5 | 6 |
| 5 | Metabolism of purines, pyrimidines, and nucleotides | 0.5 | 2 |
| 6 | Replication of DNA, mutations, and DNA repair | 0.5 | 3 |
| 7 | Transcription, RNA processing and proteins synthesis Regulation of gene expression, genetic diseases and basic techniques used in molecular genetics | 0.5 | 3  3 |
| 8 | Endocrinology | 1 | 6 |
| 9 | Biochemistry of digestive juices of GIT, digestion, and absorption in GIT | 0.5 | 3 |
| 10 | Oncogenesis and metabolism of xenobiotics | 0.5 | 3 |
| 11 | Water and Electrolyte balance; acid-base regulation | 0.5 | 2 |
|  | Total items | 9 SEQs | 45 MCQs |
|  | Total marks (5 marks for each SEQ and one mark for each MCQ) | 45 marks | 45 marks |

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

10% marks are allocated for internal assessment.

Total marks for theory paper: SEQ + MCQ + internal assessment = 45+45+10=100 marks

**Table of Specifications for Biochemistry Oral & Practical Examination**

**MBBS Second Professional Examination**

Oral and Practical Examination carries 100 marks

|  |  |
| --- | --- |
| **Examination Component** | **Marks** |
| A- Internal Assessment | **10** |
| B- Practical Notebook/Manual (Internal Examiner) | **05** |
| C- Viva voce  a. External examiner: 25 Marks  b. Internal Examiner: 25 Marks | **50** |
| D- OSPE   1. Observed stations (6 Marks): There are two observed stations; 3 marks for each station – time allowed is 3 minutes for each observed station) 2. Non-observed stations (16 Marks): There are eight non-observed stations; 2 marks for each station – time allowed is 2 minutes for each non-observed station | **22** |
| E- Practical   1. Principle, supposed calculation, etc: 4 Marks (External Examiner) 2. Performance of the experiment: 4 Marks (Internal Examiner) 3. Structured table viva: 5 Marks (External Examiner) | **13** |

**Format (Practical Examination / OSPE)**

**MBBS Second Professional Examination**

Total Marks: 100

Total marks allocated to Oral and Practical Examination is 100

Internal Assessment: 10 Marks

General Viva (Theory Viva): 50 Marks

25 Marks are allocated to internal examiner and 25 marks to external examiner. Practical Examination: 40 Marks

Practical examination comprises three components i.e. Yearly Workbook, OSPE and experiment

A- Yearly Workbook: 5 Marks (Internal Examiner)

B- OSPE: 22 marks

OSPE comprises 10 stations (two observed stations carrying 3 marks each and 8 non- observed stations 2 marks each).

List of Tests for Observed Stations (3 minutes at each station)

* 1. Spectrophotometer
  2. Centrifuge Machine
  3. Pipettes
  4. Blood samples

Non-Observed Stations (2 minutes for each station)

* 1. Tests to determine the concentration of total cholesterol, HDL cholesterol, and triacylglycerols in plasma
  2. Tests to determine the concentration of total proteins, and glucose in plasma and CSF, and albumin in plasma
  3. Determination of plasma uric acid and calcium
  4. Determination of creatinine and urea in plasma, and creatinine clearance
  5. Determination of activities of ALT and alkaline phosphatase in plasma
  6. Estimation of plasma bilirubin
  7. Determination of activities of creatine kinase, LDH, and AST

C- Experiment: 13 marks

* Principle/supposed calculations of the experiment: 4 Marks (External Examiner)
* Performance of experiment: 4 Marks (Internal Examiner)
* Table viva: 5 Marks (External Examiner)

**REGULATIONS**

1. This examination shall be open to any student who:-
   1. has been enrolled/registered and completed one academic year preceding the second professional examination in a constituent/affiliated College of the University.
   2. has passed the First Professional MBBS Examination from University of Health Sciences or an examination from any other recognised University considered equivalent for the purpose by the Academic Council, not less than one academic year previously.
   3. has his/her name submitted to the Controller of Examinations, for the purpose of examination, by the Principal of the College in which he / she is enrolled.
   4. has his/her marks of internal assessment in all the subjects sent to the Controller of Examinations by the Principal of the College alongwith the admission forms.
   5. produces the following certificates duly verified by the Principal of his / her College: of good character;
      1. of having attended not less than three-fourth (75%)
      2. of the full course of lectures delivered and practical conducted in each of the subjects of the Examination.

The Chairman of the College Academic Council / Principal of the College may condone for valid reasons deficiency up to 5% of lectures in written papers and 5% in practical. Candidates falling short of lectures or practical shall not be admitted to the examination but may be permitted to appear at the next examination if they attend 75% of the lectures delivered and practicals conducted up to the commencement of the next examination by remaining on the rolls of a College as regular student.

* 1. The detainee students shall complete all the academic requirements including attendance in the year of detention like promoted students enrolled in the class.

1. The minimum number of marks required to pass this examination for each subject shall be fifty percent (50%) in written and fifty percent (50%) in the oral & practical examination and fifty percent (50%) in aggregate, independently and concomitantly at one and the same time.
2. Candidates who secure eighty five percent (85%) or above marks in any subject shall be declared to have passed “with distinction” in that subject and no candidate who does not pass in all the subjects of the Second Professional MBBS Examination as a whole at one and the same time shall be declared to have passed “with distinction” in any subject.
3. A candidate failing in one or more subject of the annual examination shall be provisionally allowed to join third professional class till the commencement of supplementary examinations. The candidate, however, shall have to pass the failed subjects in this supplementary examination failing which he / she shall be detained in the second professional. Under no circumstances, a candidate shall be promoted to the third professional class till he / she has previously passed all the subjects in the Second Professional MBBS Examination. If a student appears in the Supplementary Examination for the first time as he/she did not appear in the annual examination and failed in any subject in the Supplementary Examination, he/she will be detained in the same class and will not be promoted to the next class.
4. Any student who fails to clear Second Professional in four chances, availed or un -availed, and has been expelled on that account shall not be eligible for continuation of medical studies for MBBS and shall not be eligible for fresh admission as a fresh candidate in either MBBS or BDS
5. Every candidate shall forward his / her application for admission to the examination to the Controller of Examination, through the Principal of the College at least four weeks before the commencement of the examination accompanied by the prescribed fee.
6. Awards of internal assessment in all the subjects of all the candidates shall be submitted to the Controller of Examinations along with Admission Forms for the annual examination. Internal assessment received after commencement of the examination shall not be accepted. The marks of internal assessment shall be submitted only once a year prior to annual examination and the same shall be counted for both annual and supplementary examinations. It is further emphasized that fresh internal assessment or a revision of assessment for supplementary examination shall not be permissible. However, it is required from the Colleges to submit a revised internal assessment for the detained students. The internal assessment award in a particular year will not be decreased subsequently detrimental to the detainee candidate. Proper record of the continuous internal assessment shall be maintained by respective departments of Medical Colleges.
7. Whenever completed admission form or the fee is received after the last date prescribed above, the candidate shall pay double the normal fee, provided that such application or fee is received at least fifteen days before the commencement of the examination.
8. The candidates shall pay their fee through the Principals of their respective Colleges who shall forward a bank draft / pay order / crossed cheque in favour of Treasurer, University of Health Sciences, Lahore along with Admission Forms.

|  |  |
| --- | --- |
| **VIII. ACADEMIC CALENDAR AND TIME TABLE** | |
| **DATE** | **TOPICS** |
| **Biochemistry of GIT (16)**  **Professor Dr. Rubina Bashir** | |
| **30-01-23** | **Saliva: Composition, functions, and related disorders** |
| **31-01-23** | **Saliva: Composition, functions, and related disorders (contd)** |
| **02-02-23** | **Gastric juice: Composition, functions, and related disorders** |
| **02-02-23** | **Gastric juice: Composition, functions, and related disorders (contd)** |
| **03-02-23** | **Gastric juice: Composition, functions, and related disorders (contd)** |
| **06-02-23** | **Pancreatic Juice: Composition, functions, and related disorders** |
| **07-02-23** | **Pancreatic Juice: Composition, functions, and related disorders (contd)** |
| **08-02-23** | **Pancreatic Juice: Composition, functions, and related disorders (contd)** |
| **08-02-23** | **Bile: Composition, functions, and related disorders** |
| **09-02-23** | **Succus entericus: Composition, functions, and related disorders** |
| **09-02-23** | **Digestion and absorption of carbohydrates and related disorders** |
| **10-02-23** | **Digestion and absorption of proteins and related disorders** |
| **13-02-23** | **Digestion and absorption of lipids and related disorders** |
| **14-02-23** | **Digestion and absorption of lipids and related disorders (contd)** |
| **16-02-23** | **Digestion and absorption of nucleic acids and bacterial flora of large intestine** |
| **16-02-23** | **Site of synthesis and major actions of GIT hormones** |
| **Metabolism of Carbohydrates (24)**  **Professor Dr. Rubina Bashir** | |
| **17-07-23** | **Introduction to metabolism and glucose transporters** |
| **18-07-23** | **Glycolysis: Reactions of aerobic and anaerobic glycolysis occurring in RBCs and other tissues** |
| **20-07-23** | **Biomedical significance and energy yield of aerobic and anaerobic glycolysis and its significance and substrate level phosphorylation** |
| **20-07-23** | **Regulation of glycolytic pathway** |
| **21-07-23** | **Regulation of glycolytic pathway (Contd)** |
| **24-07-23** | **Metabolic fates of pyruvate, lactic acidosis; genetic deficiency of pyruvate kinase and pyruvate dehydrogenase** |
| **25-07-23** | **Reactions of TCA Cycle and their regulation along with energy yield** |
| **27-07-23** | **Importance of TCA cycle and its amphibolic role** |
| **27-07-23** | **Gluconeogenesis: Reactions of gluconeogenesis using pyruvate and glycerol as precursors. Regulation of gluconeogenesis** |
| **31-07-23** | **Important gluconeogenic precursors: entrance of amino acids, intermediates of TCA cycle, glycerol, and other compounds as gluconeogenic precursors**  **Biomedical significance of gluconeogenesis: role of gluconeogenesis in plasma glucose level regulation. The Cori cycle and glucose-alanine cycle.** |
| **01-08-23** | **Glycogen metabolism: synthesis and importance of UDP-glucose, reactions of glycogenesis and glycogenolysis** |
| **03-08-23** | **Regulation of glycogen synthase and glycogen phosphorylase,**  **Importance of allosteric regulation of glycogen phosphorylase ‘a’ (a plasma glucose sensor) by plasma glucose** |
| **03-08-23** | **Disorders of glycogen metabolism (glycogen storage diseases)** |
| **04-08-23** | **Disorders of glycogen metabolism (glycogen storage diseases) (Contd)** |
| **07-08-23** | **HMP pathway: reactions of oxidative and non-oxidative phases of HMP pathway** |
| **08-08-23** | **Importance of HMP pathway along with uses of NADPH** |
| **09-08-23** | **Uses of NADPH continued, G6PD deficiency** |
| **09-08-23** | **Metabolism of fructose: metabolic fate of fructose in human body**  **Sorbitol metabolism along with effects of hyperglycemia on sorbitol metabolism, essential fructosuria and hereditary fructose intolerance** |
| **10-08-23** | **Metabolism of galactose: Metabolic fate of galactose in body, and synthesis of lactose** |
| **10-08-23** | **Disorders of galactose metabolism (galactokinase deficiency and classic galactosemia)** |
| **11-08-23** | **Uronic acid pathway: Reactions and its biological importance** |
| **15-08-23** | **Uronic acid pathway: Reactions and its biological importance (Contd)** |
| **17-08-23** | **Uronic acid pathway: Reactions and its biological importance (Contd)** |
| **17-08-23** | **Metabolism of ethanol** |
| **Metabolism of Proteins and Amino Acids (22)**  **Professor Dr. Sobia Imtiaz** | |
| **10-04-23** | **An overview of protein turnover in human body** |
| **11-04-23** | **Nitrogen balance** |
| **13-04-23** | **Inter-organ amino acid exchange in normal post absorptive state** |
| **13-04-23** | **Degradation of amino acids** |
| **14-04-23** | **Degradation of amino acids (contd)** |
| **17-04-23** | **Removal of nitrogen from amino acids by transamination & Deamination** |
| **18-04-23** | **Removal of nitrogen from amino acids by transamination & Deamination (contd)** |
| **20-04-23** | **Sources of ammonia in body, transport of ammonia, ammonia toxicity** |
| **20-04-23** | **Fate of ammonia in body, reactions, and regulation of urea cycle** |
| **21-04-23** | **Fate of ammonia in body, reactions, and regulation of urea cycle (contd)** |
| **25-04-23** | **Metabolic disorders of urea cycle** |
| **27-04-23** | **Metabolic disorders of urea cycle (contd)** |
| **27-04-23** | **Overview of amphibolic intermediates formed from the carbon skeleton of amino acids** |
| **28-04-23** | **Concept of glucogenic and ketogenic amino acids; an outline of the metabolism of individual amino acids like glycine, cysteine, arginine, proline, phenyl alanine, tyrosine, histidine, tryptophan, methionine amino acids** |
| **02-05-23** | **Concept of glucogenic and ketogenic amino acids; an outline of the metabolism of individual amino acids like glycine, cysteine, arginine, proline, phenyl alanine, tyrosine, histidine, tryptophan, methionine amino acids (contd)** |
| **03-05-23** | **Causes and salient features of important metabolic defects in amino acid metabolism like phenylketonuria, maple syrup urine disease and histidinemia** |
| **03-05-23** | **Causes and salient features of important metabolic defects in amino acid metabolism like phenylketonuria, maple syrup urine disease and histidinemia (contd)** |
| **04-05-23** | **Causes and salient features of important metabolic defects in amino acid metabolism alkaptonuria, cystathioninuria, homocystinuria, hyperprolinemia, cystinuria, & cystinosis** |
| **04-05-23** | **Causes and salient features of important metabolic defects in amino acid metabolism tyrosinemias and albinism** |
| **05-05-23** | **Metabolism of epinephrine and nor-epinephrine** |
| **08-05-23** | **Metabolism of creatine, creatinine, histamine, GABA, serotonin, melatonin, and melanin** |
| **09-05-23** | **Metabolism of creatine, creatinine, histamine, GABA, serotonin, melatonin, and melanin (contd)** |
| **Metabolism of Lipids (18)**  **Professor Dr. Rubina Bashir** | |
| **18-08-23** | **De novo synthesis of fatty acids: production of cytosolic acyl CoA, fatty acid synthase multienzyme complex** |
| **21-08-23** | **Reactions of cytosolic fatty acid synthesis** |
| **22-08-23** | **Regulation of fatty acid synthesis** |
| **24-08-23** | **Elongation of fatty acid chain, synthesis of PUFA** |
| **24-08-23** | **Synthesis and storage of TAG in body** |
| **25-08-23** | **Mobilization of stored TAG along with its regulation** |
| **28-08-23** | **Oxidation of fatty acid: Activation of fatty acids, translocation of fatty acyl CoA into mitochondrial matrix** |
| **29-08-23** | **Reactions of beta oxidation of saturated and unsaturated fatty acids, energy yield of beta oxidation** |
| **31-08-23** | **Fate of acyl CoA, other types of fatty acid oxidation (α-oxidation, Ω-Oxidation, and oxidation of odd carbon fatty acids)** |
| **31-08-23** | **Synthesis and utilization of ketone bodies: reactions of hepatic ketogenesis, and utilization of ketone bodies by extra hepatic tissues, Ketoacidosis, and regulation of ketogenesis** |
| **01-09-23** | **Cholesterol metabolism: reactions and regulation of cholesterol biosynthesis, and fate and functions of cholesterol in body** |
| **04-09-23** | **Biosynthesis and fate of bile acids and their significance in health and disease** |
| **05-09-23** | **Metabolism of phospholipids and sphingolipids: synthesis of phospholipids (phosphatidylcholine, and phosphatidylethanolamine), synthesis of glycerol and ether phospholipids (cardiolipins and platelet activating factor)** |
| **07-09-23** | **Biosynthesis of ceramide, sphingomyelin, and gangliosides, and degradation of sphingolipids along with sphingolipidosis**  **Degradation of phospholipids, deficiency of lung surfactant, metabolism of glycolipids** |
| **07-09-23** | **Plasma Lipoproteins: synthesis, transport, and fate of chylomicrons, VLDL, IDL, LDL & HDL** |
| **08-09-23** | **Plasma Lipoproteins: synthesis, transport, and fate of chylomicrons, VLDL, IDL, LDL & HDL (contd)** |
| **11-09-23** | **Disorders associated with impairment of lipoprotein metabolism, and atherogenic effects of oxidized LDL, Biochemical defects leading to fatty liver** |
| **12-09-23** | **Synthesis of eicosanoids; their regulation and functions along with their biomedical importance** |
| **Bioenergetics and Biological Oxidation (05)**  **Professor Dr. Rubina Bashir** | |
| **14-09-23** | **Endergonic and exergonic reactions, free energy, free energy change, ATP, and other compounds as carriers of energy** |
| **14-09-23** | **Electron Transport Chain: components and organization of ETC** |
| **15-09-23** | **Reactions of ETC, redox potential, methods of electron transfer among the components of ETC, and the energy release during electron transport** |
| **18-09-23** | **Oxidative Phosphorylation: ATP synthesis in ETC** |
| **19-09-23** | **Inhibitors and un-couplers of oxidative phosphorylation and chemiosmotic hypothesis of oxidative phosphorylation** |
| **Biochemistry of endocrine system-I (General endocrinology) (13)**  **Professor Dr. Sobia Imtiaz** | |
| **17-02-23** | **An overview of endocrine system; classification of hormones based on their mechanism of action and chemical nature.** |
| **20-02-23** | **An overview of endocrine system; classification of hormones based on their mechanism of action and chemical nature (contd)** |
| **21-02-23** | **General characteristics of various types of hormone receptors; types and actions of various kinds of G-proteins in mediating the action of hormones** |
| **23-02-23** | **General characteristics of various types of hormone receptors; types and actions of various kinds of G-proteins in mediating the action of hormones (contd)** |
| **23-02-23** | **Signal transduction pathways of various hormones; types and roles of various kinds of second messengers** |
| **24-02-23** | **Signal transduction pathways of various hormones; types and roles of various kinds of second messengers (contd)** |
| **27-02-23** | **Signal transduction pathways of various hormones; types and roles of various kinds of second messengers (contd)** |
| **28-02-23** | **Mechanism of action of group-I hormones** |
| **02-03-23** | **Mechanism of action of group-I hormones** |
| **02-03-23** | **Mechanism of action of group-I hormones** |
| **03-03-23** | **Mechanism of action of group-II hormones** |
| **13-03-23** | **Mechanism of action of group-II hormones** |
| **14-03-23** | **Mechanism of action of group-II hormones** |
| **Metabolism of Nucleotides (08)**  **Assistant Professor Dr. Mahwish Shahzad** | |
| **06-06-23** | **De novo synthesis of purines** |
| **08-06-23** | **De novo synthesis of purines (contd)** |
| **08-06-23** | **De novo synthesis of pyrimidines** |
| **09-06-23** | **The salvage pathways of nucleotide synthesis** |
| **12-06-23** | **The degradation of purine nucleotides** |
| **13-06-23** | **The degradation of pyrimidines nucleotides** |
| **15-06-23** | **Disorders associated with purine nucleotide metabolism like adenosine deaminase deficiency, purine nucleoside phosphorylase deficiency and hyperuricemia** |
| **15-06-23** | **Natural and synthetic derivatives of purines and pyrimidines and their role in health and disease** |
| **Biochemical Genetics (Informational Flow in the Cell) (19)**  **Prof. Dr. Rubina Bashir, Prof. Dr. Sobia Imtiaz & Dr. Mahwish Shahzad (Assistant Professor)** | |
| **11-05-23** | **The structural basis of cellular information. Organization of DNA: Chromosomes and karyotyping** |
| **11-05-23** | **Replication of DNA: reactions of DNA replication in prokaryotes** |
| **12-05-23** | **DNA replication in eukaryotes.** |
| **15-05-23** | **Types of damage to DNA and DNA repair; mutations** |
| **16-05-23** | **Transcription (DNA dependent RNA synthesis): steps in the transcription of eukaryotic and prokaryotic genes** |
| **18-05-23** | **Transcription (DNA dependent RNA synthesis): steps in the transcription of eukaryotic and prokaryotic genes (contd)** |
| **18-05-23** | **Post-transcriptional modifications (processing) of RNA; Reverse transcription and retroviruses and its relation to cancer and AIDS** |
| **19-05-23** | **Post-transcriptional modifications (processing) of RNA; Reverse transcription and retroviruses and its relation to cancer and AIDS** |
| **22-05-23** | **Regulation of gene expression in prokaryotes and eukaryotes** |
| **23-05-23** | **Translation (protein synthesis): The genetic code; components required for protein synthesis. Composition of eukaryotic and prokaryotic ribosomes** |
| **25-05-23** | **Translation (protein synthesis): The genetic code; components required for protein synthesis. Composition of eukaryotic and prokaryotic ribosomes (contd)** |
| **25-05-23** | **Steps of protein synthesis** |
| **26-05-23** | **Post- translational modifications of poly peptide chains; protein targeting** |
| **29-05-23** | **Oncogenes and their role in carcinogenesis; mechanisms of activation of proto-oncogenes** |
| **30-05-23** | **Mechanism of action of oncogenes, tumor suppressor genes and oncogenic viruses** |
| **01-06-23** | **Genetic basis of disease, Important tumor markers and their clinical significance (CEA, AFP, hCG, calcitonin, and prostatic acid phosphatase)** |
| **01-06-23** | **Molecular biology techniques: basic information and biomedical importance**  **DNA extraction; recombinant DNA technology; DNA cloning; PCR; hybridization; blotting techniques** |
| **02-06-23** | **Molecular biology techniques: basic information and biomedical importance**  **DNA extraction; recombinant DNA technology; DNA cloning; PCR; hybridization; blotting techniques (contd)** |
| **05-06-23** | **Molecular biology techniques: basic information and biomedical importance**  **DNA extraction; recombinant DNA technology; DNA cloning; PCR; hybridization; blotting techniques (contd)** |
| **Water, Electrolyte Balance; Acid-Base Regulation (05)**  **Professor Dr. Sobia Imtiaz** | |
| **09-10-23** | **Biochemical mechanisms to regulate water and electrolyte balance in body: Fluid compartments of body; gain and loss of body water** |
| **10-10-23** | **Regulation of body water balance, effect of pure water deprivation, water excess or water intoxication; and electrolytes of body fluids (sodium, potassium, magnesium, and chloride)** |
| **12-10-23** | **Body buffer systems, role of lung and kidney in maintenance of acid-base balance** |
| **12-10-23** | **Acid-base disturbances in the body, like respiratory and metabolic acidosis (lactic acidosis and ketoacidosis)** |
| **13-10-23** | **Respiratory and metabolic alkalosis; concept of anion gap, base excess, and base deficit. Clinical interpretation of laboratory reports of arterial blood gases** |
| **Integration and Regulation of Metabolic Pathways (06)**  **Assistant Professor Dr. Mahwish Shahzad** | |
| **29-09-23** | **Feed-fast cycle and starvation** |
| **02-10-23** | **Feed-fast cycle and starvation (contd)** |
| **03-10-23** | **Basic concepts of intermediary metabolism, introduction of anabolic and catabolic pathways** |
| **05-10-23** | **Basic concepts of intermediary metabolism, introduction of anabolic and catabolic pathways (contd)** |
| **05-10-23** | **An overview of regulation and integration of various metabolic pathways (role of liver, heart, brain, skeletal muscle, and adipose tissue)** |
| **06-10-23** | **An overview of regulation and integration of various metabolic pathways (role of liver, heart, brain, skeletal muscle, and adipose tissue) (contd)** |
| **Biochemistry of endocrine system-II (special endocrinology) (18)**  **Assistant Professor Dr. Mahwish Shahzad** | |
| **16-03-23** | **Hypothalamic hormones: structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all hypothalamic hormones** |
| **16-03-23** | **Pituitary hormones: biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all pituitary hormones** |
| **17-03-23** | **Pituitary hormones: biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all pituitary hormones (contd)** |
| **20-03-23** | **Disorders associated with hyper and hypo activities of these hormones (Cushing’s syndrome dwarfism, gigantism, acromegaly, Addison’s disease, diabetes insipidus, SIADH)** |
| **21-03-23** | **Thyroid hormones: structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all thyroid hormones** |
| **22-03-23** | **Disorders associated with hyper and hypo activities of these hormones like goiter, hypothyroidism, hyperthyroidism, and Grave’s disease.** |
| **22-03-23** | **Calcium regulating hormones: structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of PTH** |
| **24-03-23** | **Disorders associated with hyper and hypo activities of these hormones like role of PTH, calcitriol, and calcitonin in calcium homeostasis; hypoparathyroidism, hyperparathyroidism (primary, secondary, and tertiary), pseudohypoparathyroidism, rickets, and osteomalacia** |
| **27-03-23** | **Adrenal Cortical hormones: structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all adrenal cortical hormones** |
| **28-03-23** | **Disorders associated with hyper and hypo activities of these hormones like Cushing’s disease/ syndrome, secondary adrenal deficiency, Addison’s disease, primary and secondary aldosteronism** |
| **30-03-23** | **Adrenal Medullary hormones: structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all adrenal medullary hormones; and associated disorders like pheochromocytoma** |
| **30-03-23** | **Male and female gonadal hormones: structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all male and female gonadal hormones Disorders associated with hyper and hypo activities of these hormones like hypergonadism, and hypogonadism in males and females** |
| **31-03-23** | **Hormones of pancreas: structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all pancreatic hormones (insulin, glucagon, somatostatin, and pancreatic polypeptide)** |
| **03-04-23** | **Disorders associated with hyper and hypo activities of these hormones like pathophysiology of insulin deficiency and DM** |
| **04-04-23** | **Regulation of plasma glucose hormonally (insulin, glucagon, growth hormone, epinephrine, and cortisol) and non-hormonally.** |
| **06-04-23** | **The role of various metabolic pathways in blood glucose level regulation** |
| **06-04-23** | **Hypoglycemia and hyperglycemia: an overview of hypoglycemia and hyperglycemia, their important causes, and clinical manifestations** |
| **07-04-23** | **Diabetes mellitus: types of diabetes mellitus along with its clinical manifestations, metabolic changes in type-I and type-II DM and diagnosis of DM** |
| **Metabolism of Xenobiotics (07)**  **Professor Dr. Sobia Imtiaz** | |
| **20-09-23** | **Definition and classes of important xenobiotics of medical relevance** |
| **20-09-23** | **Definition and classes of important xenobiotics of medical relevance (contd)** |
| **21-09-23** | **Phases of metabolism of xenobiotics and clinical significance (cytochrome P450: Cytochrome P450 hydroxylase cycle in microsomes)** |
| **21-09-23** | **Phases of metabolism of xenobiotics and clinical significance (cytochrome P450: Cytochrome P450 hydroxylase cycle in microsomes) (contd)** |
| **22-09-23** | **Role of Cytochrome P450 in phase I metabolism of xenobiotics; induction of cytochrome P450** |
| **25-09-23** | **Phase II metabolism of xenobiotics: Types of phase II reactions, responses to xenobiotics including pharmacological, toxic, immunological, and carcinogenic effects** |
| **26-09-23** | **Phase II metabolism of xenobiotics: Types of phase II reactions, responses to xenobiotics including pharmacological, toxic, immunological, and carcinogenic effects (contd)** |
| **PRACTICALS (n=32)**  **Demonstrator: Dr. Momina Sajjad & Soma Sajid Facilitators: Prof Rubina Bashir & Prof. Sobia Imtiaz** | |
| **30-01-23 to 03-02-23** | **Collection, preservation & storage of blood samples** |
| **06-02-23 to 10-02-23** | **Photometry and spectrophotometry I** |
| **13-2-23 to**  **17-2-23** | **Photometry and spectrophotometry II** |
| **20-2-23 to**  **24-2-23** | **Micro-pipetting and centrifugation** |
| **27-2-23 to**  **03-3-23** | **Estimation of BSL by glucometer** |
| **13-3-23 to**  **17-3-23** | **Estimation of BSL by GOD-PAP method** |
| **20-3-23 to**  **24-3-23** | **Oral Glucose tolerance Test (OGTT)** |
| **27-3-23 to**  **31-3-23** | **Estimation of blood urea level** |
| **03-4-23 to**  **07-4-23** | **Estimation of serum creatinine level** |
| **10-4-23 to**  **14-4-23** | **Estimation of serum albumin level** |
| **17-4-23 to**  **21-4-23** | **Estimation of serum bilirubin level** |
| **24-4-23 to**  **28-4-23** | **Estimation of serum ALT level** |
| **1-5-23 to**  **5-5-23** | **Estimation of serum AST level** |
| **8-5-23 to**  **12-5-23** | **Estimation of total protein in plasma** |
| **15-5-23 to**  **19-5-23** | **Estimation of serum cholesterol level** |
| **22-5-23 to**  **26-5-23** | **Estimation of serum HDL & LDL cholesterol** |
| **29-5-23 to**  **2-6-23** | **Estimation of plasma TAG level** |
| **5-6-23 to**  **9-6-23** | **Estimation of serum uric acid level** |
| **12-6-23 to**  **15-6-23** | **Estimation of serum calcium level** |
| **17-7-23 to**  **21-7-23** | **OSPE & viva voce** |
| **24-7-23 to**  **28-7-23** | **Estimation of plasma CK & LDH level** |
| **31-7-23 to**  **4-8-23** | **Estimation of serum amylase level** |
| **7-8-23 to**  **11-8-23** | **Estimation of plasma ALP level** |
| **14-8-23 to**  **18-8-23** | **pH Metry** |
| **21-8-23 to**  **25-8-23** | **Flame photometry** |
| **28-8-23 to**  **1-9-23** | **Chromatography** |
| **4-9-23 to**  **8-9-23** | **Electrophoresis** |
| **11-9-23 to**  **15-9-23** | **ELISA** |
| **18-9-23 to**  **13-10-23** | **Revision and interactive sessions on theory topics** |
| **TUTORIALS (n=32)**  **Demonstrator: Dr. Khaulah Qureshi & Dr. M. Aadil Facilitators: Prof Rubina Bashir & Prof. Sobia Imtiaz** | |
| **30-01-23 to 03-02-23** | **Biochemistry of GIT I** |
| **06-02-23 to 10-02-23** | **Biochemistry of GIT II** |
| **13-2-23 to**  **17-2-23** | **Biochemistry of GIT III** |
| **20-2-23 to**  **24-2-23** | **General Endocrinology I** |
| **27-2-23 to**  **03-3-23** | **General Endocrinology II** |
| **13-3-23 to**  **17-3-23** | **General Endocrinology III** |
| **20-3-23 to**  **24-3-23** | **Special Endocrinology I** |
| **27-3-23 to**  **31-3-23** | **Special Endocrinology II** |
| **03-4-23 to**  **07-4-23** | **Special Endocrinology III** |
| **10-4-23 to**  **14-4-23** | **Protein Metabolism I** |
| **17-4-23 to**  **21-4-23** | **Protein Metabolism II** |
| **24-4-23 to**  **28-4-23** | **Protein Metabolism III** |
| **1-5-23 to**  **5-5-23** | **Protein Metabolism IV** |
| **8-5-23 to**  **12-5-23** | **Genetics I** |
| **15-5-23 to**  **19-5-23** | **Genetics II** |
| **22-5-23 to**  **26-5-23** | **Genetics III** |
| **29-5-23 to**  **2-6-23** | **Genetics IV** |
| **5-6-23 to**  **9-6-23** | **Nucleotide Metabolism I** |
| **12-6-23 to**  **15-6-23** | **Nucleotide Metabolism II** |
| **17-7-23 to**  **21-7-23** | **Carbohydrate Metabolism I** |
| **24-7-23 to**  **28-7-23** | **Carbohydrate Metabolism II** |
| **31-7-23 to**  **4-8-23** | **Carbohydrate Metabolism III** |
| **7-8-23 to**  **11-8-23** | **Carbohydrate Metabolism IV** |
| **14-8-23 to**  **18-8-23** | **Carbohydrate Metabolism V** |
| **21-8-23 to**  **25-8-23** | **Lipid Metabolism I** |
| **28-8-23 to**  **1-9-23** | **Lipid Metabolism II** |
| **4-9-23 to**  **8-9-23** | **Lipid Metabolism III** |
| **11-9-23 to**  **15-9-23** | **Lipid Metabolism IV** |
| **18-9-23 to**  **22-9-23** | **Electron Transport Chain** |
| **25-9-23 to**  **29-9-23** | **Xenobiotic Metabolism I** |
| **02-10-23 to**  **06-10-23** | **Xenobiotic Metabolism II** |
| **09-10-23 to**  **13-10-23** | **Acid-base balance** |

**SUMMER VACATIONS AND REMEDIAL CLASSES**

Summer vacations= 4 weeks

Remedial classes are mandatory for students who either Join late or have poor attendance/test performance or both in term I

**DEPARTMENTAL TIME TABLE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Monday | **8:00 am - 8:45 am** |  |  | **1:00 pm – 2:30 pm** |
| Biochemistry Lecture |  |  | Practical: Batch E & F (every week)  Tutorial: Batch I & J (every week) |
| Tuesday | **8:00 am - 8:45 am** |  |  | **1:00 pm – 2:30 pm** |
| Biochemistry Lecture |  |  | Practical: Batch G & H (every week)  Tutorial: Batch A & B (every week) |
| Wednesday |  |  | **09:30 am - 11:00 pm** | **1:00 pm – 2:30 pm** |
|  |  | Tutorial/Test/Lecture  Physiology/Biochemistry/Anatomy | Practical: Batch I & J (every week)  Tutorial: Batch C & D (every week) |
| Thursday |  | **9:30 am - 10:15 am** | **12:15 pm – 1:00 pm** | **1:00 pm – 2:30 pm** |
|  | Biochemistry Lecture | Biochemistry Lecture | Practical: Batch A & B (every week)  Tutorial: Batch E & F (every week) |
| Friday |  | **8:45 am -9:30 am** |  | **11:30 am – 1:00 pm** |
|  | Biochemistry Lecture |  | Practical: Batch C & D (every week)  Tutorial: Batch G & H (every week) |

**IX. COUNSELING FACILITIES FOR STUDENTS**

1. Senior faculty members of biochemistry department are actively involved in resolving academic and non-academic issues of allocated students and carrier counseling
2. Psychosocial counseling sessions (life skills) are regularly conducted by qualified student counselor
3. Individual students are also referred to the student counselor, if needed

**Robust feedback systems**

1. Feedback on attendance

Attendance report is forwarded to students and parents on daily basis

1. Feedback on academic performance

Academic performance reports are also regularly forwarded to students and parents. Moreover, individual students are given feedback on their academic performance during tutorials. MCQ and SEQ papers are also discussed with students in small groups.

1. Parents of weak students are regularly contacted (PTM sessions)