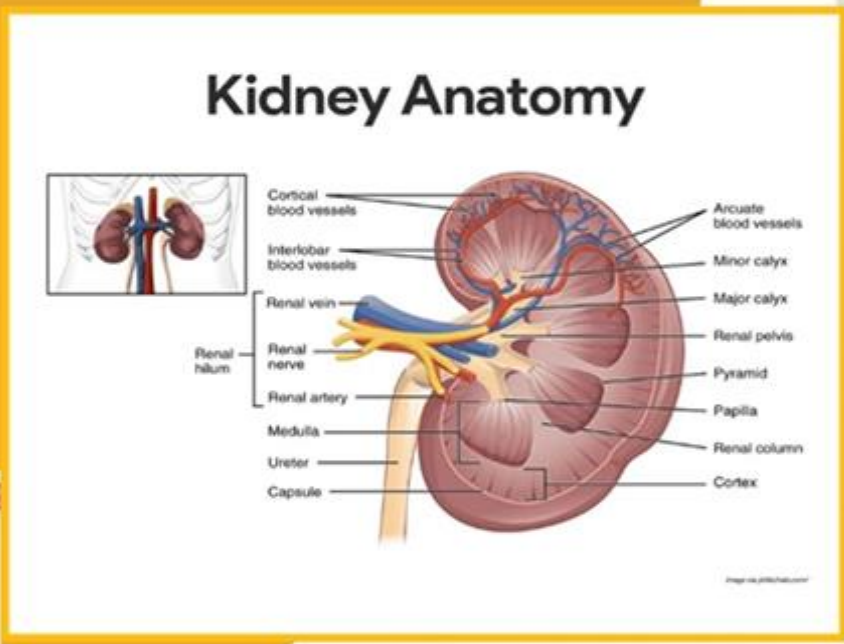
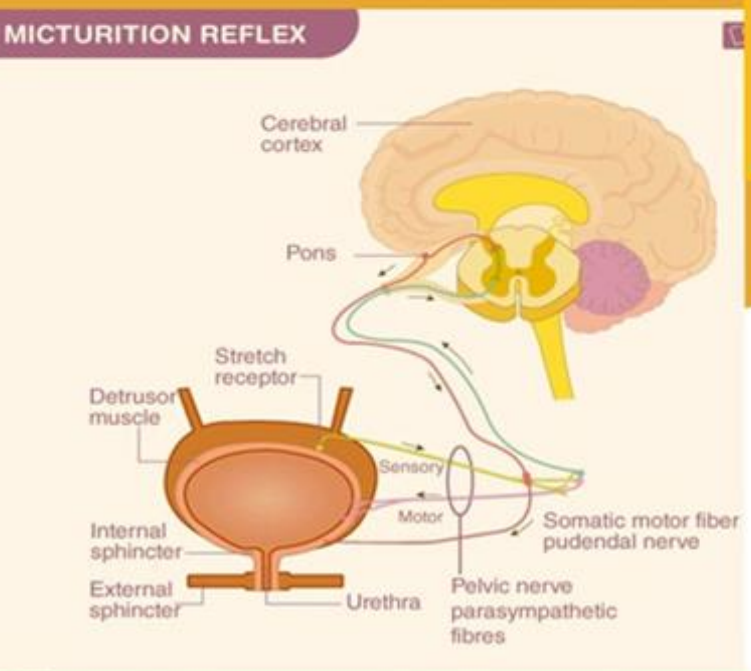
STUDY GUIDE-SECOND YEAR MBBS

21st July – 16th August 2025

Duration: 4 Weeks

RENAL AND EXCRETORY SYSTEM MODULE I





LIAQUAT NATIONAL HOSPITAL AND MEDICAL COLLEGE

Institute for Postgraduate Medical Studies & Health Science

STUDY GUIDE FOR RENAL AND EXCRETORY SYSTEM-I MODULE

Module name: **Renal & Excretory System-I** *Year:* ***Two*** *Duration:* ***4 weeks (21st July – 16th August 2025)***

Timetable hours: **Interactive Lectures, Case-Based Learning (CBL), Self-Study, Practical, Skills, Demonstrations**

MODULE INTEGRATED COMMITTEE

MODULE COORDINATOR:	• Dr. Aitmaud-Ud-Daulah Khan **(Forensic Medicine)**
CO-COORDINATORS:	• Dr. Fizza Ali (**Pharmacology**)

DEPARTMENTS & RESOURCE PERSONS FACILITATING LEARNING

BASIC HEALTH SCIENCES	CLINICAL AND ANCILLARY DEPARTMENTS
ANATOMY Professor Zia-ul-Islam	***FAMILY MEDICINE*** Dr. Rabeeya Saeed
BIOCHEMISTRY Professor Faiza Waseem	***NEPHROLOGY*** Professor Kunwer Naveed Mukhtar
PATHOLOGY Professor Naveen Faridi	***RADIOLOGY*** Professor Muhammad Ayub Mansoor
PHARMACOLOGY Professor Tabassum Zehra	***RESEARCH & SKILLS DEVELOPMENT CENTER*** Dr. Kahkashan Tahir
PHYSIOLOGY Professor Syed Hafeezul Hassan	
DEPARTMENT of HEALTH PROFESSIONS EDUCATION • Professor Nighat Huda • Professor Sobia Ali • Dr. AfifaTabassum • Dr. Yusra Nasir • Dr. Syed Asad Sibtain • Dr. Asra Zia	
LNH&MC MANAGEMENT • Professor Karimullah Makki, Principal LNH&MC • Dr. Shaheena Akbani, Director A.A&R.T LNH&MC	
STUDY GUIDE COMPILED BY: Department of Health Professions Education	

INTRODUCTION

WHAT IS A STUDY GUIDE?

It is an aid to:

- Inform students how the student learning program of the module has been organized
- Help students organize and manage their studies throughout the module
- Guide students on assessment methods, rules, and regulations

THE STUDY GUIDE:

- Communicate information on the organization and management of the module, this will help the student to contact the right person in case of any difficulty.
- Define the objectives which are expected to be achieved at the end of the module.
- Identify the learning strategies such as Interactive Lectures, small group teachings, clinical skills, demonstrations, tutorials, and case-based learning that will be implemented to achieve the module objectives.
- Provide a list of learning resources such as books, computer-assisted learning programs, web- links, and journals, for students to contour to maximize their learning.
- Highlight information on the contribution of continuous examinations on the student's overall performance.
- Include information on the assessment methods that will be held to determine every student's Achievement of objectives.
- Focus on information about examination policy, rules, and regulations.

CURRICULUM FRAMEWORK

Students will experience an integrated curriculum in the modules at LNMC by the JSMU guidelines and the most recent developments that have an impact on individual health.

INTEGRATED CURRICULUM:

Comprises of system-based modules such as Head and Neck, Neurosciences I and Endocrinology, Reproductive System-Land Renal, and Excretory System-I which links basic science knowledge to clinical problems. Integrated teaching means that subjects are presented as a meaningful whole. Students will be able to better understand basic sciences when they repeatedly learn about clinical examples.

Case-based discussions, computer-based assignments, early exposure to clinics, wards, and skills acquisition in the skills lab and physiotherapy department are characteristics of the integrated teaching program.

LEARNING METHODOLOGIES

The following teaching/learning methods are used to promote better understanding:

- Interactive Lectures
- Small Group Discussion
- Case- Based Learning
- Practical
- Skills session
- Self-Study

INTERACTIVE LECTURES

In a large group, Interactive Lecturer introduces a topic or common clinical conditions and explains the underlying phenomena through questions, pictures, videos of patients' interviews, exercises, etc. Students are actively involved in the learning process.

SMALL GROUP DISCUSSION (SGD):

This format helps students to clarify concepts and acquire skills or attitudes. Sessions are structured with the help of specific exercises such as patients' cases, interviews, or discussion topics. Students exchange opinions and apply knowledge gained from Interactive Lectures, tutorials, and self-study. The facilitator's role is to ask probing questions, summarize, or rephrase to help clarify concepts.

CASE-BASED LEARNING:

A small group discussion format where learning is focused around a series of questions based on a clinical scenario. Students discuss and answer the questions by applying relevant knowledge gained in clinical and basic health sciences during the module.

PRACTICAL:

Basic science practical's related to anatomy, biochemistry, pathology, pharmacology, and physiology are scheduled for student learning.

SKILLS SESSION:

Skills relevant to the respect modules are observed and practiced where applicable in the skills laboratory or Department of Physiotherapy.

SELF STUDY:

Students assume responsibilities for their learning through individual study, sharing and discussing with peers, and seeking information from Learning Resource Center, teachers, and resource persons within and outside the college. Students can utilize the time within the college's scheduled hours of self-study.

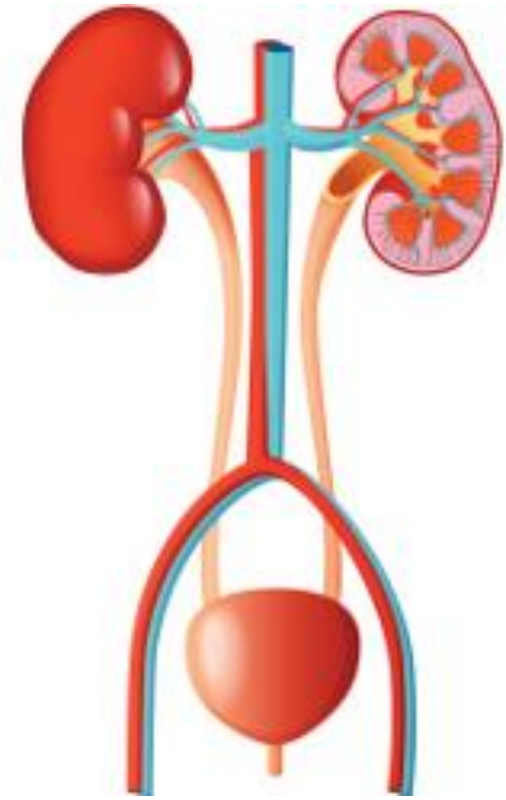
Apart from attending daily scheduled sessions, students too should engage in self-study to ensure that all the objectives are covered.

MODULE: RENAL & EXCRETORY SYSTEM-I

Rationale:

The renal and excretory systems are responsible for the body getting rid of waste and toxic substances. In this module, the renal and excretory system will be examined in detail with emphasis on how the renal system develops and functions on a cellular level as well as the mechanisms that underlie renal diseases such as electrolyte imbalance, dehydration, renal hypertension, and renal failure, and polycystic kidney, nephrotic and nephritic syndrome.

This module will enable the students of the second year to recognize the clinical presentations of common renal diseases and relate clinical manifestations to basic sciences. It will be further revisited in the following years.



COURSE TOPICS, OBJECTIVES, AND STRATEGIES

At the end of the module, the students will be able to:

ANATOMY

OBJECTIVES	LEARNING STRATEGY
1. Gross anatomy of kidneys	Interactive Lecture/ Practical
• Describe the gross structure of the kidney, its location, and shape	
• Discuss the coverings, cortex and medulla, relations and functions of kidneys	
• Discuss the clinical conditions related to kidneys	
2. Blood supply, nerve supply, and lymphatic drainage of kidneys	Interactive Lecture/ Practical
• Describe in sequence the structures passing through the hilum of the kidneys	
• Discuss the blood supply of the kidney in detail, with clinical segmentation of the kidney according to its blood supply	
• Discuss the nerve supply and lymphatic drainage of the kidney	
• Discuss the clinical conditions related to the blood supply the of kidney	
3. Gross anatomical features of the ureter and urinary bladder & urethra	Interactive Lecture/ Practical
• Enumerate the parts of the urinary system (ureter, urinary bladder, and urethra)	
• Describe the structure, course, anatomical constrictions, and relations of the ureter	
• Explain the location, apex, base, surfaces, and relations of the urinary bladder	
• Describe the trigone of the urinary bladder	
• Explain the support to the urinary bladder	
• Describe the blood supply, nerve supply, and lymphatic drainage of the ureter, urinary bladder, and urethra	
4. Surface anatomy of the Urinary system	Tutorial
• Mark the following structures on the surface of a human body/ mannequin:	
i. Kidney	
ii. Ureter	
iii. Urinary bladder	
5. Histological features of the kidney	Interactive Lecture/ Practical
• Describe the histological features of the kidney (cortex & medulla)	
• Discuss the histological features of a nephron and their types	
• Describe the filtration barrier and its significance	
• Explain the juxtaglomerular apparatus, its location, and its significance	
6. Histological features of the ureter, urinary bladder, and urethra	
• Discuss the lining epithelium of Ureter, Urinary Bladder & Urethra	
• Describe the arrangement of layers in the ureter, urinary bladder, and urethra & their microscopic appearance	
7. Development of kidney, ureter & urinary bladder	Interactive Lecture
• Describe the role of intermediate mesoderm in the formation of kidney	
• Describe the development and the fate of the three progenitors of the urinary system: pronephros, mesonephros, and metanephros	
• Discuss the development of the following:	

i. Nephron and the steps of its development	
ii. Collecting system of the kidney and ureter	
iii. Urinary bladder	
iv. Urethra	
8. Anomalies of kidney, ureter & urinary bladder	Interactive Lecture
• Describe the congenital anomalies of the kidney (polycystic kidney, pelvic kidney, horseshoe kidney), ureter (Bifid ureter), and urinary bladder	
9. Histological features of kidneys	Interactive Lecture
• Identify renal corpuscle	
• Differentiate proximal and distal convoluted tubules	
• Identify medullary rays, collecting tubules, and collecting ducts	
• Describe the histological features of kidneys	
10. Histological features of Ureter & Urinary Bladder	Interactive Lecture
• Identify the microscopic appearance and structure of the ureter & urinary bladder	
• Discuss the microscopic features of the ureter and urinary bladder	

BIOCHEMISTRY

OBJECTIVES	LEARNING STRATEGY
WATER DISTRIBUTION, REGULATION & DISTURBANCES	Interactive Lecture / CBL
1. Water distribution, regulation & disturbances	
• Describe the distribution of water in the body	
• Discuss the hormonal regulations of water homeostasis and their exchanges	
• Explain the regulatory mechanism by which the water balance is maintained	
• Discuss the biochemical consequences of dehydration and over hydration	
• Discuss the clinical disorders associated with water balance abnormalities and their management	
2. PH Disturbances	Interactive Lecture
• Describe the maintenance of normal pH	
• Discuss the renal mechanism of pH regulation	
• Discuss the biochemical consequences of respiratory and metabolic acidosis and alkalosis	
• Explain the compensatory mechanism in metabolic pH disturbances	
• Discuss the Arterial blood gases (ABGs) in metabolic pH disturbances	
• Discuss the ABGs in compensated metabolic pH disturbances	
3. Sodium and chloride disturbances	Interactive Lecture
• List the sources of dietary sodium and chloride	
• Discuss the normal daily requirement of Sodium and chloride	
• Explain the distribution of sodium in extracellular and intracellular compartments	
• Describe the biochemical role and metabolism of Sodium and chloride	
• Discuss the clinical disorders associated with sodium and chloride disturbances (e.g. Hypertension)	
• Discuss the laboratory investigations related to the disturbances of these electrolytes (e.g. dehydration and over-hydration)	

4. Potassium and phosphate disturbances	Interactive Lecture
• List the sources of dietary potassium and phosphate	
• Discuss the normal daily requirement of potassium and phosphate	
• Explain the distribution of potassium and phosphate in extracellular and intracellular compartments	
• Describe the biochemical role and the metabolism of potassium and phosphate	
• Discuss the clinical disorders associated with potassium and phosphate disturbances (e.g. hypokalemia & hyperkalemia)	
• Discuss the laboratory investigations related to the disturbances of these electrolytes	
5. Renal Function tests	Tutorial
• Discuss the clinical importance of renal disorders	
• Discuss the importance of renal function tests for the diagnosis of renal disorders	
• List the renal function tests	
• Explain the renal function tests	
• Interpret clinical conditions correlated with their laboratory investigations	
NUCLEOTIDE METABOLISM	Interactive Lecture / Tutorial
6. Purine Synthesis	
• Discuss the structure and biochemical functions of nucleotides	
• Name the different types of purines	
• Describe the sources of carbon and nitrogen atoms in the purine ring	
• Discuss the process of purine synthesis (Denovo and salvage pathways)	
• Discuss the biochemical abnormalities related to purine synthesis (e.g. Lesch –Nyhan Syndrome & Von Gierke's Diseases)	
7. Purine Degradation	Interactive Lecture / Tutorial
• Describe the fate of dietary nucleoproteins	
• Discuss the degradation of tissue purine nucleotides	
• Explain the formation of uric acid	
• Discuss the clinical significance of purine degradation abnormalities (e.g. Gout, Severe combined immunodeficiency diseases, purine nucleoside phosphorylates deficiency, and hypouricemia)	
8. Pyrimidine Metabolism	Interactive Lecture/ Tutorial
• Discuss the structure and biochemical functions of pyrimidine nucleotides	
• Name the different types of pyrimidine	
• Discuss the process of pyrimidine synthesis and degradation	
• Discuss the biochemical abnormalities related to pyrimidine synthesis (e.g. Orotic aciduria)	
9. Water, electrolytes, and pH disturbances	Interactive Lecture /Tutorial
• Discuss the clinical importance of water, electrolytes, and pH disturbances	
• Correlate the interpretation of laboratory investigations with relevant clinical conditions	
10. Detection of normal and abnormal urine constituents	Practical
• List the normal and abnormal urine constituents and their biochemical significance	
• Outline the method for detection of normal and abnormal urine constituents by chemical tests and urine dipstick	
• Detect the normal and abnormal constituents of urine by chemical tests and urine dipstick	
• Correlate the interpretation of laboratory investigations with relevant clinical conditions	

11. Urea & Creatinine estimation	Practical
• Explain the bio-techniques to estimate Urea and Creatinine in a sample	
• Explain the principle of detection of Urea and Creatinine by spectrophotometry	
• Estimate Urea and Creatinine levels by spectrophotometry	
• Correlate the interpretation of laboratory investigations with relevant clinical conditions	
12. Uric Acid estimation	Practical
• Explain the bio-techniques to estimate Uric acid in a sample	
• Explain the principle of detection of Uric acid by spectrophotometry	
• Estimate Uric acid level by spectrophotometry	
• Correlate the interpretation of laboratory investigations with relevant clinical conditions	

NEPHROLOGY

OBJECTIVES	LEARNING STRATEGY
1. Acute Renal Failure	Interactive Lecture
• Recognize the three main categories of acute kidney injury:	
✓ Pre-renal	
✓ Intrinsic renal	
✓ Post-renal	
• Discuss the diagnostic approach of acute kidney injury	
• Describe the management of acute kidney injury	
2. Chronic Renal Failure	Interactive Lecture
• Define chronic kidney disease	
• Explain the etiology & pathophysiology of chronic kidney disease	
• Describe the clinical findings of chronic kidney disease.	
• Discuss the treatment of chronic kidney disease	
3. Dialysis types & importance	Interactive Lecture
• Define dialysis	
• Discuss the purpose of dialysis	
• List the types of dialysis.	
• Explain the principles of dialysis	

PATHOLOGY

OBJECTIVES	LEARNING STRATEGY
1.Glomerular disorders	Interactive Lecture
• List the glomerular disorders	
• Explain the briefly pathogenesis and pathophysiology of glomerular disorders	
2.Renal Tubular disorders	SDL
• List the various syndromes associated with tubular defects	
• Explain briefly the pathogenesis and pathophysiology of various syndromes	

3.Pyelonephritis	Interactive Lecture
• Explain acute pyelonephritis.	
• Describe chronic pyelonephritis.	

PHARMACOLOGY

OBJECTIVES	LEARNING STRATEGY
1.Diuretics	Interactive Lecture
• List the types of diuretics	
• Explain the mechanism of action of and site of tubular action of diuretics	

PHYSIOLOGY

OBJECTIVES	LEARNING STRATEGY
1. General functions of kidneys and excretory system	Interactive Lecture
• List the general functions of kidneys	
• Describe the structure, functions, and types of the typical nephron and its blood supply.	
2. Glomerular filtration rate (GFR) and its regulating factors	Interactive Lecture/ Tutorial
• Define glomerular filtration rate	
• Explain the composition of glomerular filtrate	
• Discuss the major factors that regulate the GFR (Net filtration pressure, hydrostatic, and colloid osmotic pressures)	
3. Auto-regulation of GFR and renal blood flow	Interactive Lecture/SDL
• Define tubule glomerular feedback	
• Explain the functions of the juxta glomerular apparatus and Macula dense	
• Discuss myogenic auto-regulation	
4. Tubular reabsorption and secretion-I	Interactive Lecture
• Discuss the transport mechanisms among different segments of the renal tubule	
• Explain the regulation of tubular reabsorption and secretion	
• Discuss the hormonal control of tubular reabsorption secretion	
5. Tubular reabsorption and secretion-II	Interactive Lecture
• Elaborate the reabsorption and secretion of substances along distal tubule, colleting tubule and collecting duct.	
• Describe glomerulotubular balance in relation to regulation of tubular reabsorption.	
• Discuss the hormonal control of tubular reabsorption and secretion	
6. Urine Formation	Interactive Lecture
• Explain the renal mechanisms for excreting dilute urine.	
• Discuss the role of antidiuretic hormone in formation of concentrated urine.	
7. Concentration and dilution of urine	Interactive Lecture/ Tutorial
• Explain counter current multiplier, and counter current exchange method	
• Discuss the role of urea in urine formation	
• Define obligatory urine volume	

8. Acidification of urine	Tutorial
• Discuss different buffer systems in the body (bicarbonate, phosphate, ammonia)	
• Explain the role of kidneys in acid-base balance	
• Discuss the changes in the level of urine PH (maximum/minimum level; 4.5-8)	
9. Counter-Current Mechanism	CBL/SDL
• Explain the counter-current multiplier and exchanger.	
• Elaborate the importance of urea absorption in forming concentrated urine.	
10. Process of micturition and micturition reflex	Interactive Lecture/ Tutorial/ Practical
• Explain the physiology and innervation of the bladder	
• Explain the micturition reflex	
11. Plasma clearance and estimation of renal function	Interactive Lecture
• Determine renal plasma flow, renal blood, GFR	
• List the substances that are used to estimate renal function (PAH, inulin)	
• Calculate clearance of PAH and inulin	
12. Overview of Transport mechanisms	SDL
• List the various types of transport across the cell membrane.	
• Explain the active and passive transport mechanisms along with examples.	
13. Edema	Interactive Lecture
• Define edema along with its types.	
• Explain the causes of intracellular and extracellular edema.	
14. Buffer systems of kidneys and basis of acid base balance	Interactive Lecture
• Describe the buffer systems of body fluids; bicarbonate buffer system, phosphate buffer system	
• Explain the role of proteins as intracellular buffers.	
15. Regulation of acid-base balance	Interactive Lecture
• Elaborate the renal control of alkalosis	
• Explain the renal mechanisms for control of acidosis.	
• Describe the respiratory regulation of acid-base balance.	
16. Regulation of extracellular fluid osmolality and sodium concentration	Interactive Lecture
• Explain the osmoreceptor ADH-feedback system for control of sodium concentration.	
• Describe the importance of thirst in regulation of ECF osmolality and sodium concentration.	
17. Renal regulation of Potassium, Calcium, Phosphate and Magnesium.	Interactive Lecture
• Explain the major factors that regulate the secretion and excretion of Potassium, Calcium, Phosphate and Magnesium.	
18. Interpretation of renal function tests	Interactive Lecture
• Determine renal plasma flow, renal blood, GFR	
• List the substances that are used to estimate renal function (PAH, inulin)	

• Calculate clearance of PAH and inulin	
• Explain creatinine clearance in estimating kidney function.	
19. Endocrine functions of kidney & hormones acting on kidney	Interactive Lecture/ Flipped Classroom
• Elaborate the process of erythropoietin release from the kidneys.	
• Explain the role played by different hormones on kidney function (ADH, Angiotensin, aldosterone)	
20. Diuretics and Kidney Diseases	Interactive Lecture
• Explain the significance of Diuretics in renal diseases.	
• Briefly explain the mechanism of action of various diuretics in different segments of nephron.	
• Discuss the basic principles and indication of Dialysis in kidney diseases.	
21. Renal calculi	Tutorial
• Explain various causes of renal stones.	
22. Counter Current mechanism	Tutorial
• Discuss the process of Counter Current Mechanism and its significance in formation of concentrated urine.	

RADIOLOGY

OBJECTIVES	LEARNING STRATEGY
1.Radiological & imaging techniques of urinary tract	Practical
• Explain the radiographs and other imaging techniques of the urinary system	
•Discuss the images of the urinary tract	

RESEARCH & SKILLS DEVELOPMENT CENTER

OBJECTIVES	LEARNING STRATEGY
1.Urinary catheterization	Small Group Discussion/ Practical
• Perform Foleys catheterization on a manikin using correct aseptic techniques	
2.Open gloving technique	
•	

FAMILY MEDICINE

OBJECTIVES	LEARNING STRATEGY
1.Health Care screening	Interactive Lecture/SDL
2.Frame work of chronic disease management in primary care	Interactive Lecture/SDL

COMMUNICATION SKILLS

OBJECTIVES	LEARNING STRATEGY
1.Principles of multi media designs	Tutorial
• Define the principles of effective presentations	
• Describe Mayer's Principles of Multimedia Learning relevant to PowerPoint presentations and posters	

LEARNING RESOURCES

SUBJECT	*RESOURCES*
ANATOMY	**A. GROSS ANATOMY** 1. K.L. Moore, Clinically Oriented Anatomy 2. Neuro Anatomy by Richard Snell **B. HISTOLOGY** 1. B. YoungJ.W. Health Wheather's Functional Histology **C. EMBRYOLOGY** 1. Keith L. Moore. The Developing Human 2. Langman's Medical Embryology
BIOCHEMISTRY	**TEXTBOOKS** 1. Harper's Illustrated Biochemistry 2. Lehninger Principle of Biochemistry 3. Biochemistry by Devlin
PHYSIOLOGY	**A. TEXTBOOKS** 1. Textbook Of Medical Physiology by Guyton And Hall 2. Ganong's Review of Medical Physiology 3. Human Physiology by Lauralee Sherwood 4. Berne and Levy Physiology 5. Best and Taylor Physiological Basis of medical practice **B. REFERENCE BOOKS** 1. Guyton and Hall Physiological Review 2. Essentials Of Medical Physiology by Jaypee 3. Textbook Of Medical Physiology by Indu Khurana 4. Short Textbook of Physiology by Mrthur 5. NMS Physiology

ASSESSMENT METHODS:

- **Best Choice Questions(BCQs)** also known as MCQs (Multiple Choice Questions)
- **Objective Structured Practical Examination (OSPE)**

Internal Evaluation

- Students will be assessed comprehensively through multiple methods.
- 20% marks of internal evaluation will be added to JSMU final exam. That 20% may include class tests, assignments, practical, and the internal exam which will all have specific marks allocation.

Formative Assessment

Individual departments may hold quizzes or short answer questions to help students assess their learning. The marks obtained are not included in the internal evaluation

For JSMU Examination Policy, please consult the JSMU website!

More than 75% attendance is needed to sit for the internal and final examinations

LNH&MC EXAMINATION RULES & REGULATIONS

- Student must report to examination hall/venue, 30 minutes before the exam.
- **Exam will begin sharply at the given time.**
- No student will be allowed to enter the examination hall after 15 minutes of scheduled examination time.
- Students must sit according to their roll numbers mentioned on the seats.
- **Cell phones are strictly not allowed in the examination hall.**
- If any student is found with a cell phone in any mode (silent, switched off, or on) he/she will not be allowed to continue their exam.
- No students will be allowed to sit in an exam without University Admit Card, LNMC College ID Card, and Lab Coat
- Students must bring the following stationary items for the exam: Pen, Pencil, Eraser, and Sharpener.
- Indiscipline in the exam hall/venue is not acceptable. Students must not possess any written material or communicate with their fellow students.

SCHEDULE:

WEEKS	2nd YEAR	MONTH
WEEK 1-4	RENAL & EXCRETORY MODULE I	21st July 2025
		16th August 2025