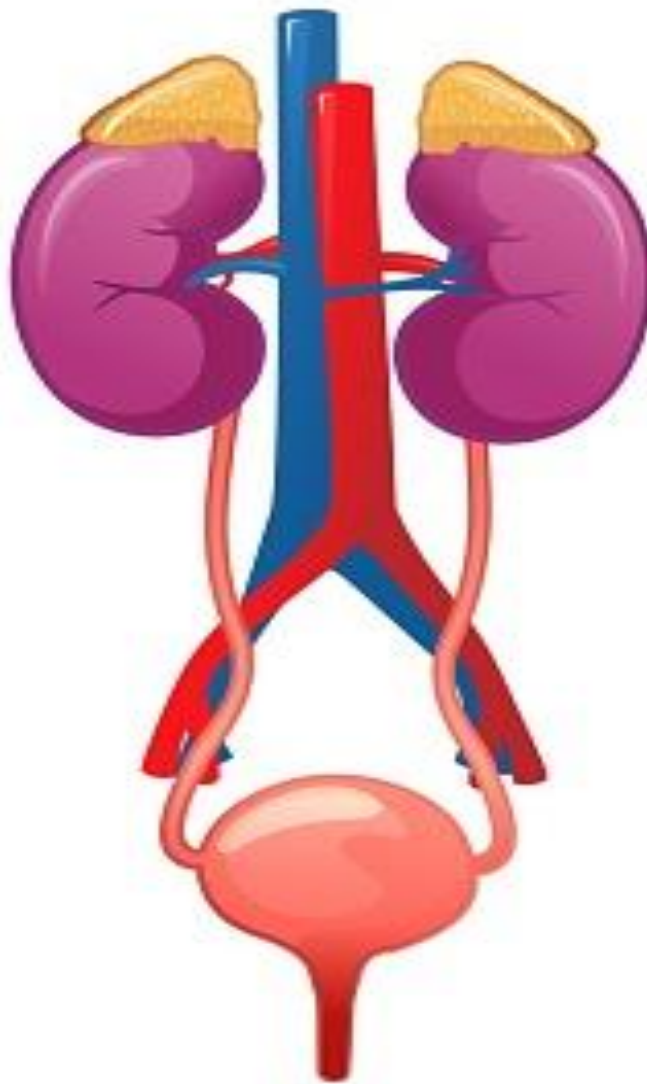


20th October – 05th November 2026
Duration: 3 Weeks

RENAL AND EXCRETORY SYSTEM - I



STUDY GUIDE FOR RENAL AND EXCRETORY SYSTEM-I MODULE

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Module name: Renal & Excretory System-I Year: Two Duration: 3 weeks (20th October – 05th November 2026)

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

MODULE INTEGRATED COMMITTEE

MODULE COORDINATOR:	• Dr. Fatima Rehman (Anatomy)
CO-COORDINATORS:	• Dr. Farzana Azam Khan (Forensic Medicine)

DEPARTMENTS & RESOURCE PERSONS FACILITATING LEARNING

BASIC HEALTH SCIENCES	CLINICAL AND ANCILLARY DEPARTMENTS
ANATOMY Professor Zia-ul-Islam	RESEARCH & SKILLS DEVELOPMENT CENTER Dr. Kahkashan Tahir
BIOCHEMISTRY Professor Faiza Waseem	
PHYSIOLOGY Professor Syed Hafeez ul Hassan	
DEPARTMENT of HEALTH PROFESSIONS EDUCATION • Professor Nighat Huda • Professor Sobia Ali • Dr. Afifa Tabassum • Dr. Yusra Nasir • Dr. Asra Zia • Dr. Maryam Fatima	
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.

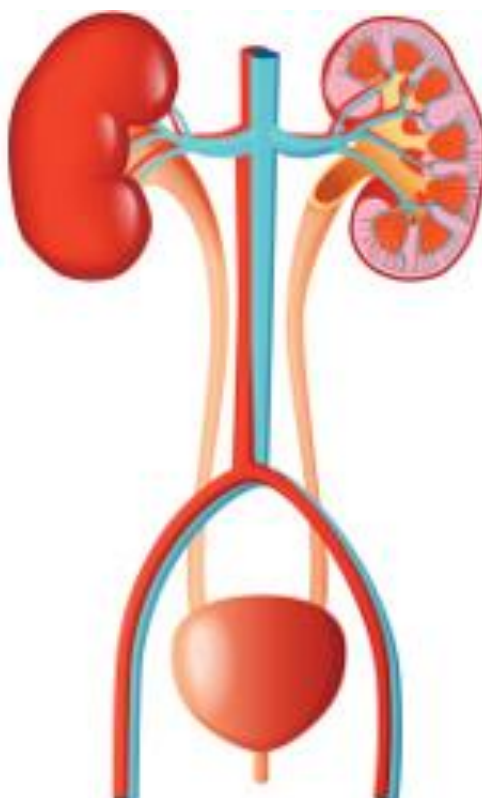


Apart from attending daily scheduled sessions, students too should engage in self-study to ensure that all the objectives are covered.

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/ Tutorial
• 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	Interactive Lecture
2. Blood supply, nerve supply, and lymphatic drainage of kidneys	
• Describe in sequence the structures passing through the hilum of kidneys with their sequence	
• 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	Interactive Lecture/ Tutorial
• Discuss the clinical conditions related to the blood supply of kidney	
3. Gross anatomical features of the ureter and urinary bladder & urethra	
• 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	Interactive Lecture
• 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	
• Mark the following structures on the surface of a human body/ mannequin:	Interactive Lecture
i. Kidney	
ii. Ureter	
iii. Urinary bladder	Interactive Lecture
5. Histological features of the kidney	
• 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	Interactive Lecture
• Explain the juxtaglomerular apparatus, its location, and its significance	
6. Histological features of the ureter, urinary bladder, and urethra	Interactive Lecture
• 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	Practical
• 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	Practical
• 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
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	

- 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	Interactive Lecture
5. Renal Function tests	
- Discuss the clinical importance of renal disorders - Discuss the importance of renal function tests for the diagnosis of renal disorders - List and explain the renal function tests - Interpret clinical conditions correlated with their laboratory investigations	Interactive Lecture
NUCLEOTIDE METABOLISM	
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)	Interactive Lecture/ Tutorial
7. Purine Degradation	
- 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)	Interactive Lecture/ Tutorial
8. Pyrimidine Metabolism	
- Discuss the structure and biochemical functions of pyrimidine nucleotides - Discuss the biochemical functions of pyrimidine nucleotides - Name the different types of pyrimidine - Discuss the process of pyrimidine synthesis - Discuss the process of pyrimidine degradation - Discuss the biochemical abnormalities related to pyrimidine synthesis (e.g. Orotic aciduria)	Interactive Lecture
9. Detection of normal and abnormal urine constituents	
- 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 - Interpret relevant clinical conditions with their laboratory investigations	Practical
10. Urea & Creatinine estimation	
- Explain the bio-techniques to estimate Urea and Creatinine in a sample - Explain the principle of detection of Urea and Creatinine by spectrophotometry	Practical

• Estimate Urea and Creatinine levels by spectrophotometry	
• Interpret relevant clinical conditions with their laboratory investigations	
11. Uric Acid estimation	
• Explain the bio-techniques to estimate Uric acid in a sample	Practical
• 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	
12. Water, electrolytes, and pH disturbances (dehydration, pH disturbances, hypernatremia, hyperkalemia, hyponatremia etc.)	
• Discuss the clinical importance of water, electrolytes, and pH disturbances	Tutorial
• Interpret clinical conditions correlated with their laboratory investigations	
13. Renal Function tests	
• Discuss the clinical importance of Renal Disorders	Tutorial
• Interpret clinical conditions correlated with their laboratory investigations	
14. Nucleotide Metabolism (e.g. Gout)	
• Discuss the clinical importance of Nucleotide Metabolism	Tutorial
• Interpret clinical conditions correlated with their laboratory investigations	

PHYSIOLOGY

OBJECTIVES	LEARNING STRATEGY
1. General functions of kidneys and excretory system	Interactive Lecture/ Tutorial
• 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
• 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
• 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 reabsorption and secretion of substances in proximal convoluted tubule and loop of Henle.	
5. Tubular reabsorption and secretion-II	Interactive Lecture
• Elaborate the reabsorption and secretion of substances along distal tubule, collecting 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. Counter-Current Mechanism	Interactive Lecture
• Explain the counter-current multiplier and exchanger. • Elaborate the importance of urea absorption in forming concentrated urine.	
8. Process of micturition and micturition reflex	Interactive Lecture
• Describe the functional anatomy of urinary bladder. • Explain the mechanism of micturition reflex and its associated abnormalities.	
9. 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.	
10. Regulation of acid-base balance	Interactive Lecture/ Tutorial
• Elaborate the renal control of alkalosis • Explain the renal mechanisms for control of acidosis. • Describe the respiratory regulation of acid-base balance.	
11. Regulation of extracellular fluid osmolality and sodium concentration	
• Explain the osmoreceptor ADH-feedback system for control of sodium concentration. • Describe the importance of thirst in regulation of ECF osmolality and sodium concentration.	Interactive Lecture
12. 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.	
13. 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.	
14. Endocrine functions of kidney & hormones acting on kidney	
• Elaborate the process of erythropoietin release from the kidneys. • Explain the role played by different hormones on kidney function (ADH, Angiotensin, aldosterone, atrial natriuretic peptide))	
15. 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.	
16. Renal calculi	
• Explain various causes of renal stones.	Tutorial
17. Counter Current mechanism	Tutorial
• Discuss the process of Counter Current Mechanism and its significance in formation of concentrated urine.	
18. Edema	Tutorial

• Define edema along with its types.	
• Explain the causes of intracellular and extracellular edema.	
19. Nephrotic Syndrome	
• Discuss the causes of Nephrotic Syndrome	CBL
• Discuss the risk factors of Nephrotic Syndrome	
• Discuss the clinical features of Nephrotic Syndrome	
20. Urinary Tract Infection	
• Identify the clinical scenario of UTI on the basis of urine D/R	CBL
21. Concentration and dilution of urine	
• Explain counter current multiplier, and counter current exchange method	Interactive Lecture/ Tutorial
• Discuss the role of urea in urine formation	
• Define obligatory urine volume	
• List the various types of transport across the cell membrane.	
• Explain the active and passive transport mechanisms along with examples.	

RESEARCH & SKILLS DEVELOPMENT CENTER

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

LONGITUDINAL THEMES

Communication skills, Leadership, Professionalism and Bioethics (LeaPE), Patient Safety and Research

TOPICS & OBJECTIVES	LEARNING STRATEGY
• Objectives and reading material are uploaded on Moodle for each longitudinal theme	Interactive lectures

LEARNING RESOURCES

SUBJECT	RESOURCES
ANATOMY	A. <u>GROSS ANATOMY</u> 1. K.L. Moore, Clinically Oriented Anatomy 2. Neuro Anatomy by Richard Snell B. <u>HISTOLOGY</u> 1. B. Young J.W. Health Wheather's Functional Histology C. <u>EMBRYOLOGY</u> 1. Keith L. Moore. The Developing Human 2. Langman's Medical Embryology
BIOCHEMISTRY	<u>TEXTBOOKS</u> 1. Harper's Illustrated Biochemistry 2. Lehninger Principle of Biochemistry 3. Biochemistry by Devlin
PHYSIOLOGY	A. <u>TEXTBOOKS</u> 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. <u>REFERENCE BOOKS</u> 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	2 nd YEAR	MONTH
3 WEEKS	RENAL & EXCRETORY MODULE I	20 th October 2026
		05 th November 2026
	PRE-PROFESSIONAL EXAM	

Final dates will be announced later.

