

# PEOPLES UNIVERSITY OF MEDICAL & HEALTH SCIENCES FOR WOMEN.(SBA)



## RENAL **MODULE –V** STUDY GUIDE Second Year MBBS

<b>S.No</b>	<b>TABLE OF CONTENTS</b>
1	Introduction to Study Guide
2	Five Year Curricular Organization
3	Overview
4	Integrated Module Committee
5	Module description
6	Rationale
7	Learning Outcomes
8	Module Objectives
8	Discipline-wise Objectives and Contents
9	Learning Resources
10	Assessment Methods

## INTRODUCTION

### WHAT IS A STUDY GUIDE?

A study guide provides a focus for different educational activities in which the students are engaged. It equips students with information on the topic of study and assists in management of student learning. Furthermore, it imparts relevant information about the organization of the module and thus helps students organize their educational activities accordingly. Another important purpose of a study guide is the dissemination of information about rules and policies and teaching and assessment methods.

### HOW DOES A STUDY GUIDE HELP LEARNERS?

- Includes information on organization and management of the module.
- Advises the learners about representatives who can be contacted in case of need.
- Defines the outcomes and objectives which are expected to be achieved at the end of the module.
- Elaborates the teaching and learning strategies which will be implemented during the module.
- Inform learners about the learning resources in order to maximize their learning.
- Provides information about the assessment methods that will be held to determine every student's achievement of objectives.

### CURRICULUM MODEL:

Integrated modular curriculum is followed at **Peoples University of Medical & Health Sciences for Women (SBA)** for MBBS program. This implies that instead of studying basic and clinical sciences separate and apart, students will experience a balanced and integrated combination of basic and clinical sciences in the form of a system –based modules.

The modular curriculum followed by **Peoples University of Medical & Health Sciences for Women (SBA)** is integrated both in the vertical and the horizontal directions. However, in order to prepare the students for clinical teaching with a sound background knowledge of the basic sciences, the curriculum has been divided in three spirals.

The three spirals are:

- 1. Spiral -1 Basic Sciences**
- 2. Spiral -2 Clinical Sciences**
- 3. Spiral -3 Integrated Supervised Practical Training**

The Basic Sciences Spiral is spread over the first two years and Clinical Sciences Spiral is distributed over the next two years. In the final year students are given practical hands-on training in the role similar to that of a shadow house officer. The whole curriculum is divided into modules, each module being related to a particular system. For example, Cardiovascular 1 module is in the Basic Sciences Spiral-1 and Cardiovascular 2 module is in the Clinical Sciences Spiral-2 and the relevant practical and clinical teaching/learning will be accomplished in Final year Spiral-3.

## **TEACHING & LEARNING METHODOLOGIES:**

The following teaching/ learning methods may be used to facilitate the learning process:

1. **Interactive Lectures:** Lectures are considered as an efficient means of transferring knowledge to large audiences.
2. **Small Group Discussion:** Small group discussion such as Demonstrations, tutorials and case- based learning (CBL) sessions facilitate interactive learning which helps students develop discussion skills and critical thinking.
3. **Practical:** Practical related to Basic Sciences are held to facilitate student learning.
4. **Skills:** Skills sessions are scheduled parallel with various modules at fully equipped Skills Lab and Simulation Lab in which students observe and learn skills relevant to the respective modules under guidance of Clinical Faculty.
5. **Self-Directed Learning (Self- Study):** Students have a measure of control over their own learning. They diagnose their needs, set objectives in accordance to their specific needs, identify resources and adjust their pace of learning

## 5 YEAR CURRICULAR ORGANIZATION

SPIRAL	YEAR	MODULES				
<b>First Spiral</b>	<b>I</b>	<b>FND1- Foundation</b> Cell, Genetics & Cell Death (Basics of Anatomy, Physiology, Biochemistry, Gen. Pathology, Gen. Pharmacology, Community Medicine & Behavioral Sciences,  <b>9 Weeks</b>		<b>HEM1- Blood Module</b> Immunity, Inflammation, Tissue repair, Antimicrobials & Neoplasia <b>9 Week</b>		
		LCM1- Locomotion Bones, Joints, Nerves & Muscles, 9weeks		RSP1- Respiratory System 6 weeks	CVS1- Cardiovascular System 4 weeks	
	<b>II</b>	NEU1- Nervous System 8 weeks		HNN1- Head & Neck & Special 6 weeks	END1- Endocrinology 5weeks	
		GIL 1-GIT and Liver 8 weeks		<b>EXC1- Renal and Excretory System</b> <b>5 weeks</b>	REP1- Reproductive System 5 weeks	
<b>Second Spiral</b>	<b>III</b>	Foundation 2 2 wks	IDD Infectious diseases 1-6 weeks	HEM2- Hematology 5 weeks	RSP2- Respiratory System 5 weeks	CVS2- Cardiovascular System 4 weeks
		GIL 2-GIT and Liver (including Nutritional Disorders) 8weeks			EXC2- Renal & Excretory System 4 weeks	END2- Endocrinology 5 weeks
	<b>IV</b>	ORT2- Orthopedics, Rheumatology, Trauma 7 weeks		PMR-Physical Medicine & Rehabilitation DPS-Dermatology Plastic Surgery / Burns GEN-Genetics 6 weeks		REP2- Reproductive System 8 Weeks
		NEU2- Neurosciences and Psychiatry weeks			ENT* 4 weeks	OPHTHALMOLOGY/ EYE 4 weeks
<b>Third Spiral</b>	<b>V</b>	Clinical Rotation 9:45 to 3:00 (with Ambulatory, Emergency, Intensive care) In Medicine, Pediatrics, Cardiology and Neurology units ✦ Lecture on problem based approach, twice a week ✦ Ward tutorial twice a week ✦ Student research presentation once a week			Clinical Rotation 9:45 to 3:00 (Inpatient, Ambulatory, Emergency, Intensive care and Operation Theatres) In Surgery, Gynecology & Obstetrics, Orthopedics and Neurosurgery. ✦ Lecture on problem based approach, twice a week ✦ Ward tutorial twice a week ✦ Student research presentation once a week	

## OVERVIEW

<b>Program</b>	<b>MBBS</b>	
Year	Two	
Module Title	Renal and Excretory System	
Module Code	EXC-1	
Duration	5 weeks	
	Anatomy	18.5
	Biochemistry	12.5
	Physiology	24.5
	Pathology	18
	Pharmacology	5
	Community medicine	3
	Medicine	6
	Behavioral Science	3
	Radiology	1
	Skill Lab	3
<b>Total Hours</b>	<b>Renal and Excretory System-I Module</b>	<b>94.5</b>

## **MODULE DESCRIPTION:**

This module has been designed for students to introduce them to the basic concepts of Excretory System of the body. This module includes Anatomy, Physiology, Biochemistry, Pathology, Pharmacology, Community Medicine, Medicine, Behavioral Sciences, Radiology and related skills.

Lectures, tutorials, small group sessions including CBL, demonstrations with simulation and practical are important components of this module. The basic concepts of the urinary system and its related diseases will be thoroughly covered in this module. You will be able to apply your medical knowledge to practical situations by means of group and individual tasks. This study guide has been developed to assist you and keep you focused to achieve your goals.

Welcome to the Renal & Excretory System module and it is hoped that students will be able to achieve the desired module learning outcomes.

## **RATIONALE:**

Renal system is involved in the excretion of waste products especially nitrogenous end products of protein metabolism. It regulates normal hydrogen ion concentration, pH and acid base balance, maintains sodium and potassium and electrolyte balance of the body also maintain blood pressure, osmotic pressure, water balance, plasma / extra cellular fluid volume. Renal diseases are common in the community and renal failure is a common end stage of most renal disorders. Understanding of the basic anatomy, physiology and biochemical processes is essential for dealing with the disease processes afflicting the renal system. This module provides this basic understanding.

## **LEARNING OUTCOMES**

### **At the end of Five years MBBS program, student shall be able to:**

- Identify the common problems related to the urinary system
- To show improved confidence, attitudes and skills in treating the kidney and urinary system related diseases
- Manage appropriate referrals regarding problems of urinary system.

## **MODULE OBJECTIVES**

### **At the end of module, 2nd year MBBS student should be able to:**

- Describe the anatomy and physiology of the urinary system, including the structure and function of major organs including kidney, ureter urinary bladder and urethra.
- Comprehend the mechanisms of glomerular filtration, tubular reabsorption, and tubular secretion.
- Describe the regulation of water and electrolyte balance and maintenance of blood pressure in the body, including the role of hormones.
- Explain the regulation of acid-base balance of the body and renal mechanism of acid-base regulation.
- Recognize the pathophysiology of common renal disorders such as acute and chronic kidney diseases, nephrotic and nephritic syndromes, and renal failure.
- Explain method of electrolyte balance and pathologies related to it.
- Understand the principles of pharmacological management for various renal disorders and the use of diuretics.
- Identify the basic principles of diagnosis, treatment, and prevention of renal disorders.
- Interpret renal function tests and laboratory investigations used in diagnosing renal disorders.



# **DISCIPLINE-WISE LEARNING OBJECTIVES AND CONTENTS**

## **ANATOMY**

### **Learning Objectives:**

- List the parts of excretory system.
- Describe the gross morphological feature of kidney with its relations, neurovasculature and lymphatic drainage.
- Identify the structure, course, relation and neurovasculature of ureter.
- Describe the structure and parts of urinary bladder along with its location, relations, nerve supply, blood supply and lymphatic drainage.
- Explain the structure, location and neurovasculature of urethra.
- Differentiate the parts of urethra in male and female.
- Locate the kidney, ureters and urinary bladder on the surface of the body.
- Identify the microscopic features of kidney, ureter, urinary bladder and urethra.
- Describe the development and related developmental anomalies of kidney, ureter, urinary bladder and urethra.

### **Topics/ Contents:**

#### **Lectures: (50 Minutes each)**

- Overview of excretory system of the body and structure of kidney.
- Details of gross anatomical features of kidney
- Details of blood and nerve supply and lymphatic drainage of kidney
- Gross anatomical features of ureter, urinary bladder and urethra
- Blood supply, lymphatic drainage and nerve supply of ureter, urinary bladder and urethra
- Surface Anatomy of Urinary system
- Microscopic Features of kidney: (Detailed microscopic features of nephron and collecting ducts)
- Microscopic features of collecting ducts ureter, urinary bladder & Urethra.
- Development of Kidney & Ureter
- Development of urinary bladder and urethra
- Congenital anomalies of kidney and urinary tract
- ONLINE LECTURE: Gross anatomical features of kidney , ureter, urinary bladder and urethra blood and nerve supply and lymphatic drainage of kidney, of ureter, urinary bladder and urethra
- ONLINE LECTURE: Development of kidney, ureter, urinary bladder and urethra. Congenital anomalies of kidney and urinary tract

**Practicals: (1.5 Hour each)**

- Microscopic Features of kidney: (detailed microscopic features of nephron and collecting ducts)
- Microscopic features of collecting ducts ureter, urinary bladder & Urethra.
- SIMULATION: Gross anatomical features, relations of kidney, ureter, urinary bladder and urethra blood and nerve supply and lymphatic drainage of kidney, of ureter, urinary bladder and urethra

## **PHYSIOLOGY**

### **Learning Objectives:**

- Explain water's importance, list fluid compartments, estimate volumes based on sex and mass, compare their compositions, and discuss measuring methods.
- Compare interstitial fluid and lymph, define the lymphatic system's structure and function, utilize subjectspecific vocabulary accurately, and explain its role in body health.
- Discuss fluid overload effects and responses, fluid depletion effects, notably on the cardiovascular system, and immediate and long-term physiological reactions.
- Discuss kidney functions, waste disposal, renal blood flow, renal corpuscle and tubule anatomy, the JGA, and the three roles of nephrons and collecting ducts.
- Explain filtration membrane, glomerular filtration pressures, greater glomerular filtration rate, plasma-filtrate chemical differences, and net filtration pressure calculation.
- Explain glomerular filtration rate (GFR) regulation and autoregulation, including macula densa cells, and how hormones affect GFR in acute and long-term situations.
- Define nephrotic syndrome, explain its causes and risk factors, outline epidemiology, describe clinical features, and establish diagnoses.
- Explain substance reabsorption routes, label membranes, detail sodium reabsorption in PCT and nephron loop, chart water and sodium reabsorption percentages, and note hormonal regulation if applicable.
- Explain intercalated cell hydrogen ion secretion, describe sodium reabsorption in DCT and collecting duct, note associated solutes, graph water and sodium reabsorption percentages, and specify hormonal regulation if applicable.
- Explain renal plasma clearance, its relevance, and the disparities in glucose, urea, and creatinine clearances compared to glomerular filtration rate.
- Discuss urine concentration and dilution in renal tubules and collecting ducts, symporters and main cells, ADH's involvement in water reabsorption, the countercurrent mechanism, and its importance.
- Compare plasma, interstitial fluid, and intracellular fluid electrolyte compositions and observe sodium, chloride, potassium, bicarbonate, calcium, phosphate, and magnesium ion functions and regulation.
- Explain thirst's connection to body water levels, describe the main route of water loss, define ADH's role in water regulation, and identify dehydration causes.
- Explain extrinsic GFR control by the renin-angiotensin system, natriuretic peptides, and sympathetic activity, describe their role in urine composition, and define additional kidney-regulating hormones.
- Explain normal urine pH and its range, bicarbonate ion reabsorption and H<sup>+</sup> secretion in the proximal tubule, the phosphate buffer system, and glutamic acid's role in H<sup>+</sup> buffering.
- Understand acid-base imbalances, their type, causes, anion gap calculation, compensation formulas, and electrolyte imbalances, especially potassium, sodium, magnesium, and phosphate, and sodium's role in fluid status, hypernatremia, and hyponatremia.

- Define micturition, identify urinary organs, compare male and female urethras, explain the micturition reflex, and describe neural control of micturition.
- Define urinalysis and emphasize its significance, outline the features of normal urine, identify typical chemical substances in urine, and explain methods for evaluating kidney function.

**Topics/Contents:**

**Lectures: (50 Minutes each)**

- Compartments of body fluids and measurement
- Tissue and lymph fluids
- Fluid excess / depletion
- General functions of kidney & excretory system
- GFR & factors affecting GFR
- GFR regulation
- Nephrotic syndrome
- Tubular reabsorption & secretion – early nephron
- Tubular reabsorption & secretion – late nephron
- Plasma clearance
- Concentration & dilution of urine
- Electrolyte balance
- Water balance
- Endocrine functions of kidney & hormones acting on kidney
- Acidification of urine
- Metabolic acidosis & alkalosis
- Micturition, micturition abnormalities including incontinence
- Renal function tests / Renal failure / uremia

**Tutorials: (1.5 hour each)**

- Tubular reabsorption & secretion
- Metabolic acidosis & alkalosis

## **BIOCHEMISTRY**

### **Learning Objectives:**

- Define acidosis and alkalosis
- Explain the role of Buffers in maintaining acid base balance
- Explain the mechanism underlying the development of acidosis and alkalosis
- list the biochemical changes in acidosis and alkalosis
- Explain the pathway of Purine and Pyrimidine biosynthesis.
- Discuss the role of various amino acids in the synthesis of AMP and GMP. • Describe the role of folic acid and CO<sub>2</sub> in the synthesis AMP and GMP
- Recall the structure of Pyrimidine base and sources of C & N atoms.
- Comprehend the pathway and factors regulating the Pyrimidine biosynthesis
- Comprehend the salvage pathway
- Comprehend the deoxyribonucleotides synthesis
- Discuss the salvage pathways of purine basis
- Describe the regulation of purine synthesis and its regulation and catabolism to form uric acid, in liver and skeletal muscle.
- Define nucleic acid metabolism disorders
- Define gout, sign and symptoms, causes and treatment.
- Describe the importance of Renal Function Test (RFT) and key role of urine constituents with relation to RFT.
- Interpret the different steps involved in renal functioning and their biochemical role.
- Discuss the normal constituents and composition of urine.
- Discuss the abnormal constituents of urine and their importance
- Explain the importance of creatinine
- Differentiate between creatine and creatinine.
- Describe the principle of creatinine estimation • Demonstrate the procedure of creatinine estimation
- Interpret normal value of serum creatinine.

### **Topics/Contents:**

#### **Lectures: (50 Minutes each)**

- Renal control of pH and buffer systems
- Purine metabolism (synthesis & breakdown)
- Pyrimidine metabolism (synthesis & breakdown)
- Salvage pathway of nucleotides
- Uric acid metabolism and gout

**Practical: (1.5 hour each)**

- Urinary analysis of Abnormal constituents (dipstick method)
- Analysis of Serum Urea/Creatinine/Electrolytes **Tutorial: (1.5 hour each)**
- Renal compensation in Acidosis & alkalosis (case discussion)
- Renal Function Test
- Normal/Abnormal constituents of Urine

## **PATHOLOGY**

### **Learning Objectives:**

- Enlist the major developmental anomalies of the Kidneys and the lower urinary tract.
- Describe their clinical features.
- Enlist the clinical manifestations of renal disease.
- Describe the spectrum of glomerular disorders.
- Enumerate immune mechanisms of glomerular injury
- Differentiate between nephrotic and nephritic syndrome.
- Explain the mechanisms of tubulo- interstitial injury.
- Enlist the clinical features of the infections of upper and lower urinary tract infections.
- Describe the histopathological changes related to the infections of the urinary tract.
- Enlist the clinical features related to the stone formation in the kidneys.
- Describe features of various types of stones
- Describe the histopathological changes related to the obstructive uropathy.
- Describe the fundamental pathological concepts of renal transplant.
- Explain the significance of the lab investigations related to renal transplant.
- Describe the pathogenesis of the cancer of urinary bladder.
- Explain the gross appearance of renal cancers

### **Topics/Contents:**

#### **Lectures: (50 Minutes each)**

- Anomalies of Kidney and Lower Urinary Tract
- Pathogenesis of Glomerular Disorders-1
- Pathogenesis of Glomerular Disorders-2
- Nephritic Syndrome
- Tubulointerstitial Diseases
- Revisit Diseases affecting Tubules and Interstitium
- Diseases involving Renal Blood vessels
- Pyelonephritis
- Obstructive Uropathy
- Lower urinary tract infections
- Revisit: Infections of the Renal System
- Introduction to Renal Transplant **Practicals: (1.5 hour each)**

- Lab Investigations for Transplant
- Pathology Museum: Renal Calculi and Hydronephrosis
- Pathology Museum: Bladder and Renal Cancers
- Pathology Museum: Pyelonephritis and Renal TB



## **COMMUNITY MEDICINE**

### **Learning Objectives:**

- Apply all levels of prevention and control measures for prevention and control of chronic kidney diseases
- Analyze methods for prevention and control of Hypertension in community.
- Relate the epidemiology and prevention of Kidney Stones.

### **Topics/Contents:**

#### **Lectures: (50 Minutes each)**

- Prevention and control of chronic kidney diseases
- Prevention and control of Hypertension
- Kidney Stones: Prevalence, Incidence, and prevention

## **PHARMACOLOGY**

### **Learning Objectives:**

- Know the different sites of nephron where different group of diuretics can act
- Identify different clinical conditions where role of diuretics is important and mandatory

### **Topics/Contents:**

#### **Lectures: (50 Minutes each)**

- Diuretics-I
- Diuretics-II

#### **Tutorials: (1.5 hour each)**

- Over view of Diuretics

## **MEDICINE**

### **Learning Objectives:**

- Define dehydration and overhydration.
- Discuss the normal distribution of body water and electrolytes
- Discuss the functional anatomy and physiology of renal water handling
- Discuss the etiology and clinical assessment of hyponatremia
- List the investigations needed in hyponatremia and discuss its management
- Discuss the etiology and clinical assessment of hypernatremia
- List the investigations needed in hypernatremia and discuss its management..
- Differentiate between acidaemia & alkalaemia.
- Calculate the anion gap, differentiate between normal or high anion gap acidosis. • Identify disorders and causes of acid base disturbances
- Manage each acid base disturbance adequately.
- Define acute renal failure (ARF) and chronic renal failure (CRF).
- Compare and contrast the distinction between the three major pathophysiologic etiologies for ARF.
- Describe the metabolic consequences of significant reductions in renal function.
- Distinguish between pre-renal and intrinsic renal disease
- Interpret a urinalysis, including microscopic examination for casts, red blood cells, white blood cells, and crystals.
- Develop appropriate initial management plan for acute renal failure including volume management, electrolyte monitoring, and indications for dialysis.
- Discuss the etiology, diagnosis and treatment of CRF.
- Define different renal replacement therapies
- Outline the complications and treatment options associated with alterations in calcium, phosphate, vitamin D and parathyroid hormone levels.
- List the basic instruction for urine collection and factors affecting quality of a specimen
- List the various components of urine report
- Interpret Physical, Chemicals and Microscopic findings of urine report.

### **Topics/ Contents:**

#### **Lectures (50 Minutes each)**

- Dehydration/ over-hydration (Part 1)
- Dehydration/ over-hydration (Part 2)
- Urine detail report sample collection and biochemical analysis
- Interpret the ABG reports for the diagnosis of acidosis and alkalosis
- Renal failure clinical picture and presentation (Part I) ARF

- Renal failure clinical picture and presentation (Part II) CRF

## **BEHAVIORAL SCIENCES**

### **Learning Objectives:**

- Understand ethical and legal issues in patient care pertinent to trauma injury, DSH and organ transplant.

### **Topics/ Contents:**

#### **Lectures (50 Minutes each)**

- Ethical and legal issues in patient care (trauma, injury, DSH)
- Treatment Adherence in Chronic Diseases, Defining Adherence, Treatment Non-Adherence, Improving Adherence
- Counseling in Medical Practice: Counsellor Characteristics, Counselling Techniques

## **RADIOLOGY**

### **Learning Objectives:**

- List different types of imaging modalities for excretory system like ultrasound, X-ray, CT, KUB, and IVP.
- Identify the indications / contraindications of different imaging modalities
- Recognize normal appearance of excretory structures on X-RAY, CT SCAN, and IVU.

### **Topics/ Contents:**

#### **Lectures (50 Minutes each)**

- Radiological overview and imaging techniques of excretory system

## **SKILLS LAB**

### **Clinical Breast Examination**

Introduction/Rationale:

Urethral catheterization is an invasive procedure with several potential hazards if not performed potentially. It is imperative that all health professionals be thoroughly versed with the procedure. Learning objectives:

- List the equipments required for the procedure.
- Demonstrate the correct aseptic techniques and the procedure for urinary catheterization in male and female.

## **LEARNING RESOURCES**

### **ANATOMY**

- Clinically Oriented Anatomy Textbook by Anne MR Agur, Arthur F Dalley, and Keith L. Moore
- Gray's Anatomy for Students by Richard L. Drake, A. Wayne Vogl, Adam W. M. Mitchell 4th Edition
- B. Young J. W. Health Wheater's Functional Histology
- Langman's Medical Embryology

### **BIOCHEMISTRY**

- Harper's Illustrated Biochemistry
- Lippincott's Illustrated reviews of Biochemistry
- Lehninger's Principles of Biochemistry
- Biochemistry by Devlin

### **PHYSIOLOGY**

- Textbook Of Medical Physiology by Guyton And Hall
- Ganong's Review of Medical Physiology
- Human Physiology by Lauralee Sherwood

### **PATHOLOGY**

- Robbins Basic Pathology Kumar & Abbas 10th Edition
- Robbins & Cotran Pathologic Basis Of Disease Kumar & Abbas & Aster 10th Edition

### **COMMUNITY MEDICINE**

- Public Health And Community Medicine Shah, Ilyas, Ansari 7th Edition

### **PHARMACOLOGY**

- Lippincott's Illustrated Review Pharmacology Karen Whalen 6th Or Latest Edition
- Basic And Clinical Pharmacology Bertram G. Katzung 11th Edition

### **MEDICINE**

- Principles & Practice Of Medicine Davidson's 22nd Or Latest Edition
- Essentials Of Kumar And Clark's Clinical Medicine Kumar & Clark 9th Or Latest Edition
- Macleod's Clinical Examination Douglas & Nicol & Robertson 13th Or Latest Edition
- Hutchison's Clinical Methods William M Drake & Michael Glynn 23rd Or Latest Edition

## **ASSESSMENT**

Assessment will be done in two parts:

### **At the end of module**

- Module Exam (Theory) -20%
- Module Exam Practical Internal Evaluation- 20%

### **At the end of Year**

- Annual Exam (Theory) -80%
- Annual Exam (OSPE, Viva)-80%

MCQs (Multiple choice questions), OSPE (Objective Structured Practical Exam) and structured vivas will be the main assessment tool.