REGULATIONS AND CURRICULUM GOVERNING

M.Sc. Renal Dialysis Technology Program

Implemented in the Academic Year 2020-21
Amended up to 2025

Name of the Constituent Unit: Yenepoya School of Allied Health Sciences

RABBI ZIDNI 'ILMA

YENEPOYA
(DEEMED TO BE UNIVERSITY)

Deralakatte, Mangalore, Karnataka.

NOTIFICATION FROM THE UNIVERSITY

Sl. No.	ACM with date	BOM/BOS with date	Decisions/Approvals
1.	39th ACM/ 27.08.2020	50th BOM/ 28.8.2020	Starting of M.Sc. Renal Dialysis Technology program under the Faculty of Allied and Healthcare Professions and approval of the Curriculum & Regulations.
2.	43rd ACM/ 07.07.2021	54th BOM/ 08.07.2021	Approved the introduction of the Choice Based Credit System (CBCS) for the M.Sc. Renal Dialysis Technology programme.
3.	51st ACM/ 16.05.2023	62nd BOM/ 14.06.2023	Approval of CBCS regulations: Form CIA 40% and SEE 60% to CIA 50% and SEE 50%. Minimum pass marks for CIA shall be 50% and SEE shall be 50%
4.	58th ACM/ 13.08.2024	4th Executive council/ 10.09.2024	Approved the amendment of the dissertation credit distribution from 6 credits to 12 credits.
5.	63rd ACM/ 13.05.2025	8th Executive council /10.06.2025	Approved the amendment on Structured continuous internal assessment components of PG dissertation

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1. Preamble

Health care sector has become one of the largest employment generation sectors in India and abroad. Rapidly changing and expanding horizon of the health care sector demands formal training programs in all its Allied areas. Postgraduate Program in Allied Health sciences speciality often encompasses a wide range of disciplines. The learning during postgraduation is usually heavily research focused. Professionals in the medical field rely heavily on modern technology to successfully treat, diagnose, and care for patients. By doing postgraduation in Allied health disciplines one will be preparing for a career as an educator, researcher, or technologist. Students may find a variety of options upon completion of post-graduation such as managing the Laboratories, Operation theatres, Radiology suites and Dialysis units. They can also join as teachers in the faculty of Allied and health professionals. They can also do research pursue doctorate in their field of interest. They can also join biomedical equipment manufacturing company and pharmaceutical company as experts in their field.

The postgraduation in Renal Dialysis Technology will prepare the candidate for a career as an educator, researcher, or therapist. Students may find a variety of options upon completion of post-graduation such as clinical instructor for dialysis therapist. Academic and Research pursuit are other areas that offer opportunities for professional growth and development. The scope of growth in the field is tremendous with the improving healthcare system with an increase in dialysis care facilities. To match our education system with the international educational pattern all the postgraduate programs are with Choice Based Credit System.

2. Definitions

2.1. Academic Year:

Two consecutive (one odd + one even) semesters constitute one academic year.

2.2. Choice Based Credit System:

The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

2.3. Course:

Usually referred to, as ‘papers‟ is a component of a program. The courses shall define learning objectives and learning outcomes. A course shall comprise lectures/tutorials/laboratorywork/fieldwork/outreachactivities/projectwork/vocationaltraining/viva/seminars/termpapers/assignments/presentations/self-studyetc.oracombination of some of these.

2.4. Credits:

Credit defines the quantum of contents/syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus ,normally in each of the courses, credits will be assigned on the basis of the number of lectures/tutorial laboratory work and other forms of learning required, to complete the course contents minimum of 15-weekschedule:Onecredit=1hour of lecture per week/two hours of Laboratory or practical/three hours of clinical rotation, field work/posting. All courses need not carry the same credits.

2.5. Programs:

An educational program leading to award of a degree, diploma or certificate.

2.6. Grade Point:

It is a numerical weight allotted to each letter grade on a10-pointscale.

2.7. Credit Point:

It is the product of grade point and number of credits for a course.

2.8. Cumulative Grade Point Average (CGPA):

It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

2.9. Letter Grade:

It is an index of the performance of students in a said course. Grades are denoted by letters: O+, O, A+, A, B+, P, F.

2.10. Semester Grade Point Average (SGPA):

It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

2.11. Transcript or Grade Card or Certificate:

Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester.

Type of Courses

2.12. Core course:

A course that should compulsorily be studied by a candidate as a core requirement is termed as a core course. This is the core requirement to complete the M.Sc. Renal Dialysis Technology Program.

2.13. Skill Enhancement Course:

These courses are aimed at improving practical, professional & procedural knowledge requirement for carrying the highly skilled task related to the field of study.

2.14. Multidisciplinary Elective:

Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline or subject or domain or nurtures the candidate's proficiency skill.

A candidate shall have the freedom to choose Multidisciplinary Elective courses during the academic duration of the particular PG Program offered by Yenepoya (deemed to be) University through the PG departments or SWAYAM/MOOC external online platforms or a mix of courses offered by Yenepoya(deemed to be) University and SWAYAM/MOOC as appropriate.

i. A candidate opting for SWAYAM/MOOC courses shall have the freedom to choose the courses of once own choice and complete such courses before appearing fourth Semester End Examination.
ii. A candidate shall compulsorily submit the pass certificate of each course successfully completed to the controller of examination of Yenepoya (deemed to be) University through the proper channel before appearing the fourth semester end examination.
iii. A candidate opting multidisciplinary elective courses offered by the Yenepoya (deemed to be) University through the PG departments need to take up these courses generally during second and third semesters of the program.
iv. A candidate shall not take the courses offered by the department in which she/he is enrolled.
v. Registration for the multidisciplinary elective courses offered by the Yenepoya (deemed to be) University shall be at least one week prior to the commencement of the course with the CBCS coordinator. The CBCS unit shall notify the list of courses after being approved by the respective BOS. For SWAYAM/MOOC courses shall be as per the enrollment notification by the respective implementation authorities.

Yenepoya (deemed to be) University shall adapt the regulations of UGC governing SWAYAM/MOOC courses as amended from time to time.

3. Eligibility for Admission

To be eligible for admission a candidate shall have obtained a bachelor degree (B.Sc. Renal Dialysis Technology) from University established under law considered equivalent by thereto by Yenepoya (Deemed to be University). The candidate shall have obtained minimum of 50% aggregate of marks in all the years of University examination of degree course.

In case of SC/ST/OBC candidates the minimum marks shall be 45%.

4. Duration of the Program

The duration of the program shall extend over 4 semesters (2 academic years) of 15 weeks or more each with a minimum of 90 actual working days of instructions in each semester and 2 – 3 weeks of examinations. The successful completion will lead to Masters' degree in Renal Dialysis Technology.

Semester

An academic year shall consist of two semesters;

Odd Semester 1st& 3rd	September/October to February/March
Even semester 2nd& 4th	March/April to August/September

5. Maximum period for completion of the Program

A Candidate shall complete the four semesters (two years) program within four years from the date of admission.

6. Aim of the Program

The aim of the M.Sc. Renal Dialysis Technology program is to prepare competent, ethically responsible, and research-oriented renal dialysis professionals with advanced knowledge and skills in renal replacement therapies. The program seeks to develop graduates who can deliver safe, evidence-based, and patient-centred dialysis care; manage and maintain advanced dialysis technologies; contribute to quality assurance and infection control practices; participate in clinical research and innovation; and assume leadership, teaching, and supervisory roles in dialysis units, academic institutions, and healthcare organizations.

7. Outcomes of the Program

Upon successful completion of the Masters' program, students will have developed a broad knowledge of the contribution of basic renal scientific mechanisms to clinical disorders of the excretory system.

In particular they will:

PO 1: Understand how mechanisms operating at the molecular, cell, network and system sub-level serve normal function and how damage or dysfunction at these different levels produce specific disorders of importance to clinical dialysis therapy. (K)

PO 2: Have a good working knowledge of modern methods for scientific and clinical investigation of the human excretory system. (K, S)

PO 3: Be aware of the major recent developments in research in the area of clinical dialysis therapy. (K)

PO 4: Be able to embark upon a successful career in their chosen direction of advanced nephro- research. (S, A)

<u>Expected skill to be acquired by the end of the Program:</u>

PO 5: Supervises the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts, including planning and scheduling. (S, C, A)

PO 6: Providing expert support within the unit in the handling of all hemodialysis and peritoneal dialysis related and patient related issues, e.g., dialysis complications, dietary consultations, psychological care and vascular access issues in coordination with the nephrologists. (S, C, A)

PO 7: Monitoring the dialysis patients for intra dialytic complications. (S)

PO 8: Guiding and teaching the students about pediatric dialysis. (S, C, A)

PO 9: Guiding the staff and students on dialysis unit policies, infection control and quality control standards as per unit polices. (K, S, C)

PO 10: Quality maintenance and overall supervision of special procedures performed by the unit e.g., CRRT, ICU dialysis, pediatric dialysis, plasmapheresis, hemoperfusion, SCUF, and MARS. (K, S, A)

PO 11: Supervising the conduct of regular ongoing patient education, nutritional counseling programs in the dialysis unit. (S, C, A)

PO 12: Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues. (S, C, A)

Program Structure

	Broad category of course	Hours/Credits	Course (Title + Course Code)
1.	**Discipline-Specific Courses**		
a)	Theory	**I Semester**	
		60 Hours / 4 Credits	Renal Anatomy and Physiology
		60 Hours / 4 Credits	Renal Pathology and Microbiology
		45 Hours / 3 Credits	Biostatistics & Research Methodology
		II Semester	
		45 Hours / 3 Credits	Renal Pharmacology
		45 Hours / 3 Credits	Nephrology and Kidney Disease
		45 Hours / 3 Credits	Biomedical Instrumentation
		45 Hours / 3 Credits	Bioethics
		III Semester	
		45 Hours / 3 Credits	Complications of Dialysis & Dialysis Equipment
		45 Hours / 3 Credits	Nutrition & Quality Assurance in dialysis
		45 Hours / 3 Credits	Health Care Management
		IV Semester	
		45 Hours / 3 Credits	Recent Advances in Dialysis and Nephrology
		45 Hours / 3 Credits	Psychosocial Issues & Rehabilitation in dialysis patient
		45 Hours / 3 Credits	Renal transplantation

	Broad category of course	Hours/Credits	Course (Title + Course Code)
1.	**Discipline-Specific Courses**		
b)	Practical (SEC)*	**I Semester**	
		120 Hours /4 Credits	Clinical Dialysis I (Practical I)
		II Semester	
		120 Hours /4 Credits	Clinical Dialysis II (Practical I)
		III Semester	
		120 Hours /4 Credits	Clinical Dialysis III (Practical I)
		IV Semester	
		120 Hours /4 Credits	Clinical Dialysis IV (Practical I)
c)	Clinical (SEC)*	**I Semester**	
		225 Hours /5 Credits	Clinical Dialysis I (Practical II)
		II Semester	
		180 Hours /4 Credits	Clinical Dialysis II (Practical II)
		III Semester	
		180 Hours /4 Credits	Clinical Dialysis III (Practical II)
		IV Semester	
		180 Hours /4 Credits	Clinical Dialysis IV (Practical II)
2.	**Curriculum Enrichment Courses**		
a)	Research Project	12 credits	Dissertation
3.	**Electives**		
a)	Interdisciplinary Courses	90 Hours/6 Credits	Coursera/Swayam
	Total	**92 Credits**	

SEC: Skill Enhancement Course

8. Attendance

8.1. Each course (theory, practical, clinical etc.) shall be treated as an independent unit for the purpose of attendance. Candidates having minimum 80% attendance in each of the Courses can only qualify to appear for the Semester End Examination. The Candidates with less than 80% of attendance shall be required to repeat that Course by attending the semester.

8.2. There shall be no provision for condonation of shortage of attendance.

8.3. For SWAYAM/MOOC/NPTEL it shall be as per the regulations governing the courses of implementing authority.

8.4. The HOD/Course Coordinator through the Dean of Faculties shall announce the names of the candidates who will not be eligible to take the Semester End-Examinations (SEE) in the various courses and send a copy of the same to the Controller of Examinations (COE) Office. Registrations of such candidates for those courses shall be treated as cancelled.

9. Syllabus/Course Contents

I Semester

Course Title: Renal Anatomy & Physiology

Course: Core

Credits: 3 **No. of Hours: 45**

Course Outcomes:

After completing this course the students will be able to:

a. Describe the Structural & Gross anatomy of Kidney
b. Describe the microscopic structure of the kidney
c. Explain Body Fluids.
d. Describe the mechanism of urine formation.
e. Explain renal autoregulation
f. Describe the physiology of peritoneum

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	5	**Basic anatomy of urinary system** 1.1. Gross anatomy of kidney	✓			20%	LE
		1.2. Embryology and fetal development in brief	✓				
		1.3. Anatomy of Peritoneum	✓				
II	10	**Histology of the kidney** 2.1 T.S of a human kidney		✓		10%	SE
		2.2 Photomicrograph of part of the renal cortex			✓		

		2.3 Photomicrograph of the blood supply to the kidney cortex			✓		
		2.4 Photomicrograph of the renal corpuscle			✓		
		2.5 Microscope of the visceral epithelium			✓		
		2.6 Microscope of a peripheral portion of a Renal corpuscle			✓		
		2.7 Electron microscope filtration barrier			✓		
		2.8 Diagram of a lobule of glomerular capillaries			✓		
		2.9 Juxta glomerular complex			✓		
		2.10 Renal cortex			✓		
		2.11 Renal cortex showing the proximal convoluted tubule and distal convoluted tubule			✓		
		2.12 Proximal convoluted tubule			✓		
		2.13 Renal medulla			✓		
		2.14 Renal papilla			✓		
		2.15 Distal convoluted tubule			✓		
		2.16 Collecting tubule			✓		
		2.17 Deep cortical area and outer medulla			✓		
		2.18 Kidney cortex the JG apparatus			✓		
		2.19 Kidney Medulla – papilla			✓		
		2.20 Papilla adjacent to a calyx, longitudinal			✓		

		2.21 TS of ureter			✓		
		2.22 Ureter wall TS			✓		
		2.23 Urinary bladder TS			✓		
		2.24 Urinary Bladder mucosa			✓		
III	10	**Kidney & Body Fluids** 3.1.The body fluid compartments: extracellular and intracellular fluids interstitial fluid and edema	✓			25%	LE, SE
		3.1.1. Body fluid compartments	✓				
		3.1.2. Constituents of extracellular and intracellular fluids	✓				
		3.1.3. Osmotic equilibria and fluid shifts between the extracellular and intracellular fluids	✓				
		3.1.4. Changes in the volumes and osmolality of the extracellular and intracellular fluid compartments in abnormal states	✓				
		3.1.5. Edema fluids in the potential spaces of the body	✓				
		3.2. Formation of urine by the kidney: Renal Blood Flow, Glomerular filtration and their control.					
		3.2.1. Physiologic anatomy of the kidney	✓				
		3.2.2. Basic theory of nephron function	✓				
		3.2.3. Renal blood flow and pressures	✓				

		3.2.4. Glomerular filtration and the glomerular filtrate	✓				
		3.2.5. Control of the glomerular filtration rate and renal blood flow	✓				
		3.2.6. Reabsorption of fluid by the peri-tubular capillaries	✓				
		3.3. Formation of urine by the kidney: Processing of the filtrate in the tubules					
		3.3.1. Effect of tubular load and tubular transport maximum on urine constituents	✓				
		3.3.2. The concept of Plasma Clearance its use in assessing renal function	✓				
		3.4. Renal associated mechanism for controlling extracellular fluid osmolality and sodium concentration					
		3.4.1. The mechanism for excreting excess water: Excretion of a dilute urine	✓				
		3.4.2. The mechanism for excreting excess solutes: The counter current mechanism for excreting a concentrated urine	✓				
		3.4.3. Control of extracellular fluid osmolality and sodium concentration	✓				
		3.4.4. Sodium excretion and its control by aldosterone	✓				
		3.4.5. Control of blood volume	✓				
		3.4.6. Control of extra cellular fluid	✓				

		volume					
		3.4.7. Urea excretion	✓				
		3.4.8. Potassium excretion	✓				
		3.4.9. Control of the extracellular concentrations of other ions	✓				
		3.5. Regulation of Acid-Base Balance	✓				
		3.5.1. Function of Acid – Base Buffers	✓				
		3.5.2. Respiratory regulation of Acid – Base balance	✓				
		3.5.3. Renal control of Hydrogen Ion concentration	✓				
		3.5.4. Clinical abnormalities of Acid-Base Balance	✓				
		3.6. Renal Disease, Diuresis, and Micturition					
		3.6.1. Renal Disease		✓			
		3.6.2. Renal Function tests		✓			
		3.6.3. Diuretics and mechanisms of their actions		✓			
		3.6.4. Micturition		✓			
IV	10	**Physiology of Peritoneum** **4.1. Diffusion through the peritoneum**	✓			25%	LE, SE
		4.1.1. Definition		✓			
		4.1.2. Factors influencing solute transport		✓			

		4.1.3. Peritoneal permeability		✓			
		4.1.4. Solute characteristics		✓			
		4.1.5. Concentration gradient		✓			
		4.1.6. Peritoneal blood flow		✓			
		4.1.7. Dialysis solution temperature		✓			
		4.1.8. Available membrane area		✓			
		.2. Routes of solute transport					
		4.2.1. Intracellular.	✓				
		4.2.2. Extracellular.	✓				
		4.3. Factors that enhance diffusion.					
		4.3.1. Increased dialysis solution flow.		✓			
		4.3.2. Increased blood flow.		✓			
		4.3.3. High concentration gradient.		✓			
		4.3.4. Pre-warmed dialysis solution.		✓			
		4.3.5. Osmotic pressure		✓			
		4.4. Osmosis through the peritoneal membrane.					
		4.4.1. Ultrafiltration.		✓			
		4.4.2. Drug transport		✓			
V	10	**Anatomy of vascular system related to hemodialysis** **5.1. Upper limb vessels.**				20%	SE

		5.1.1. Course, distribution, branches, origin, and abnormalities.	✓				
		5.2. Neck vessels.					
		5.2.1. Course, distribution, branches, origin, and abnormalities.	✓				
		5.3. Femoral vessels.					
		5.3.1. Course, distribution, branches, origin, and abnormalities	✓				

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Chaurasia BD. Human anatomy. CBS Publisher; 2004.
2. Skorecki K, Chertow GM, Marsden PA, Taal MW, Alan SL. Brenner & Rector's the kidney.Philadelphia, PA: Elsevier; 2016.
3. Waugh A, Ross GA. Wilson anatomy and physiology in health and illness

Course Title: Renal Pathology & Microbiology

Course: Core

Credits: 3 No. of Hours: 45

Course Outcomes:

After completing this course the students will be able to:

a. Describe the Congenital anomalies
b. Describe the Glomerular diseases
c. Explain Urolithiasis
d. Define the urinary tract infection
e. Explain opportunistic infections
f. Describe the infection control practices in dialysis unit

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	5	**Renal Pathology** **Congenital Anomalies** 1.1.Cystic Diseases of the kidney	✓			10%	LE, SE
		1.2.Cystic Renal Dysplasia	✓				
		1.3.Autosomal Dominant	✓				

		(Adult) Polycystic Kidney Disease					
		1.4. Autosomal Recessive (Childhood) Polycystic Kidney Disease	✓				
		1.5. Cystic Diseases of Renal Medulla	✓				
		1.6. Medullary sponge kidney	✓				
		1.7. Nephronophthisis-Uremic Medullary Cystic Disease Complex	✓				
		1.8. Acquired (Dialysis - Associated) Cystic Disease	✓				
		1.9. Simple cysts	✓				
II	10	**Glomerular Diseases** 2.1. Clinical manifestations	✓			20%	LE, SE
		2.2. Alterations		✓			
		2.3. Pathogenesis of Glomerular injury		✓			
		2.4. In situ Immune Complex Deposition					
		2.4.1. Anti-GBM Nephritis	✓				

		2.4.2. Heyman Nephritis	✓				
		2.4.3. Antibodies against Planted Antigens	✓				
		2.4.4. Circulating Immune Complex Nephritis	✓				
		2.4.5. Antibodies to Glomerular Cells	✓				
		2.4.6. Cell-Mediated Immunity in Glomerulonephritis	✓				
		2.4.7. Activation of Alternative Complement Pathway	✓				
		2.4.8. Epithelial Cell Injury	✓				
		2.4.8.1. Mediators of Glomerular injury • Cells • Soluble Mediators	✓				
		2.4.8.2. Mechanisms of progression in Glomerular Disease					
		2.4.8.3. Acute Glomerulonephritis	✓				
		• Acute Proliferative (Post streptococcal, Post infectious) Glomerulonephritis	✓				
		• Post streptococcal Glomerulonephritis	✓				
		• Non streptococcal Acute Glomerulonephritis	✓				
		2.4.9. Rapidly Progressive (Crescentic) Glomerulonephritis	✓				

		2.4.10. Nephrotic Syndrome					
		2.4.11. Membranous Glomerulonephritis (Membranous Nephropathy)	✓				
		2.4.11. Minimal Change Disease (Lipoid Nephrosis)	✓				
		2.4.12. Focal Segmental Glomerulosclerosis	✓				
		2.4.13. Membrano-proliferative Glomerulosclerosis	✓				
		2.4.14. IgA Nephropathy (Berger Disease)	✓				
		2.4.15. Focal Proliferative And Necrotizing Glomerulonephritis (Focal Glomerulonephritis)					
		2.4.16. Hereditary Nephritis	✓				
		2.4.16.1. Alport syndrome	✓				
		2.4.16.2. Thin Membrane Disease (Benign familial Hematuria)	✓				
III	5	**Chronic Glomerulonephritis** **3.1. Glomerular Lesions Associated with Systemic Disease** 3.1.1. Systemic Lupus Erythematosus	✓			15%	LE, SE
		3.1.2. Henoch-Schoenlein Purpura	✓				
		3.1.3. Bacterial Endocarditis					
		3.1.4. Diabetic Glomerulosclerosis	✓				

		3.1.5. Amyloidosis	✓				
		3.1.6. Fibrillary and Immunotactoid Glomerulonephritis	✓				
		3.1.7. Other Systemic Disorders			✓		
		3.2. Diseases Affecting Tubules And Interstitium					
		3.2.1. Acute Tubular Necrosis	✓				
		3.2.2. Tubulointerstitial Nephritis	✓				
		• Pyelonephritis and Urinary Tract Infection	✓				
		• Acute Pyelonephritis	✓				
		• Chronic Pyelonephritis and Reflux Nephropathy	✓				
		• Tubulointerstitial Nephritis Induced by Drugs and Toxins	✓				
		3.2.3. Acute Drug-Induced Interstitial Nephritis	✓				
		Analgesic Abuse Nephropathy	✓				
		Nephropathy Associated with Nonsteroidal Anti-Inflammatory Drugs	✓				
		3.3. Other Tubulointerstitial Diseases			✓		
		3.4. Urate	✓				

		Nephropathy					
		3.5. Hypercal cemia and Nephrocalcinosis	✓				
		3.6. Multiple Myeloma	✓				
IV	5	**Diseases of Blood Vessels** 4.1. Benign Nephrosclerosis	✓			10%	SE
		4.2. Malignant Hypertension and Accelerated Nephrosclerosis	✓				
		4.3. Renal Artery Stenosis	✓				
		4.4. Thrombotic Microangiopathies	✓				
		4.5. Classic (Childhood) Hemolytic-Uremic Syndrome	✓				
		4.6. Adult Hemolytic-Uremic Syndrome/Thrombotic Thrombocytopenic Purpura	✓				
		4.7. Other Vascular Disorders	✓				
		4.8. Atherosclerotic Ischemic Renal Diseases	✓				
		4.9. Sickle Cell Diseases Nephropathy	✓				
		4.10. Diffuse Cortical Necrosis	✓				
		4.11. Renal Infarcts	✓				
V	2	**Urinary Tract Obstruction (Obstructive Uropathy)**	✓			5%	SE
VI	3	**Urolithiasis (Renal Calculi, Stones)**	✓			5%	SE

VII	5	**Tumors Of the Kidney** **7.1. Benign Tumors** 7.1.1. Renal Papillary Adenoma	✓			10%	SE
		7.1.2. Renal Fibroma or Hematoma (Renomedullary Interstitial Cell Tumor)	✓				
		7.1.3. Angiomyolipoma	✓				
		7.1.4. Oncocytoma	✓				
		7.2. Malignant Tumors					
		7.2.1. Renal Cell Carcinoma (Hypernephroma, Adenocarcinoma of Kidney) Classification of Renal Cell Carcinoma: Histology, Cytogenetics, and Genetics	✓				
		7.2.2. Urothelial Carcinomas of Renal Pelvis	✓				
VII I	10	**Microbiology** 8.1. Microbiology of UTI	✓			25%	LE, SE
		8.2. Hepatotrophic viruses in detail – mode of transfusion universal precautions, vaccinations.	✓				
		8.3. HIV- Mode of transfusion, universal precautions.	✓				
		8.4. Opportunistic infections.	✓				
		8.5. Microbiology of vascular access infection – Femoral, jugular, subclavian catheters. (Bacterial infection).	✓				

		8.6. Sampling methodologies for culture & sensitivity.		✓			
		8.7. Vancomycin resistant enterococci & other antimicrobial - resistant bacteria (Drug, resistant micro-organisms).		✓			
		8.8. Infections through contaminated HD equipment's or dialysate or errors in reprocessing.	✓				
		8.9.Non infections agents in HD pts • Endotoxin • Endotoxin A • Other biological toxins		✓			
		8.10. Infection control precautions for Dialysis units	✓				
		8.11. Sterilization & Disinfection • Sterilization and disinfection classification, principle, methods • Central sterile supply department.			✓		

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Fogo AB, Cohen AH, Colvin RB, Jennette JC, Alpers CE. Fundamentals of renal pathology. Berlin: Springer; 2014.
2. Fogo AB, Kashgarian M. Diagnostic Atlas of Renal Pathology E-Book. Elsevier Health Sciences; 2016 Sep 21.
3. Mohan H. TEXTBOOK OF PATHOLOGY, Harsh Mohan, 2010, JAYPEE BROTHERS MEDICAL PUBLISHERS (P) LTD. Jaypee brothers Medical Publishers (P) ltd; 2010.
4. Baveja CP. Textbook of microbiology. Arya Publications; 2005

Course Title: Research Methodology & Biostatistics

Course: Core

Credits: 3 **No. of Hours: 45**

Research Methodology

Course Outcomes:

At the end of the Course, the students will;

a. Have knowledge of process involved in Biomedical research from formulation to publication.
b. Be able to draft a research proposal.

Course Content

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
Unit I	**2 hours**	**1. Introduction** 1.1 Need for research	✓			10%	**SE**
		1.2 Types of research	✓				
		1.3 Outlining the research process	✓				

Unit II	**2 hours**	**2. Review of Literature** 2.1 Importance, sources & steps	✓			10%	**SE**
		2.2 Critical appraisal of research article	✓				
Unit III	**2 hours**	**3. Research Design** 3.1 Types of research – Qualitative & Quantitative	✓			10%	**LE,SE**
		3.2 Experimental & Non Experimental, Survey – advantages & disadvantages	✓				
Unit IV	**2 hours**	**4. Research Process** 4.1 Framing a research question	✓			15%	**LE,SE**
		4.2 Research title	✓				
		4.3 Aim & Objectives, Assumptions, Limitations & Delimitations, Variables	✓				
		4.4 Hypothesis – formation & testing	✓				
Unit V		**5. Data collection & analysis**	✓			20%	**LE,SE**

	2 hours	5.1 Data sources, technique of data collection, tools					
		5.2 Reliability & validity	✓				
		5.3 Process of data collection	✓				
		5.4 Pilot study – method, need	✓				
Unit VI	**2 hours**	6. **Interpretation & presentation of data** 6.1 Qualitative & quantitative analysis	✓			15%	**LE,SE**
		6.2 Graphical representation of data	✓				
		6.3 Conclusion & discussion	✓				
Unit VII	**2 hours**	7. **Discussion, Conclusion and References**	✓			10%	**SE**
Unit VIII	**2 hours**	8. **Essentials of writing a research paper along with process of publication**	✓			10%	**LE**

Biostatistics

Course Outcome:

At the end of the Course, the students will be able to

a. Able to distinguish different data types, variables and scales of measurement
b. Able to organize, tabulate and present data through tables and graphs. Compute and interpret descriptive statistics
c. Able to compute and interpret sensitivity, specificity, PPV, NPV and ROC Analysis.
d. Able to determine sample size and use of random sampling methods.
e. Able to interpret Power of a test, Level of significance, p value and confidence interval. Use of t-test, ANOVA and m3ultiple comparison.
f. To interpret the commonly used parametric and nonparametric tests and how to report the findings.
g. Carryout correlation analysis and interpret the results
h. Perform regression analysis and draw conclusions of the analysis. Use the regression model for predictions.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
Unit I	**6 hours**	**1. Introduction** 1.1 Introduction to biostatistics &research methodology, types of variables & scales of measurements, measure of central tendency & dispersion, rate, ratio, proportion,	✓			5%	**LE,SE**

		incidence & prevalence					
Unit II	**3 hours**	2. **Sampling** 2.1 Population & Sample, Sampling and non-sampling errors and methods of minimizing these errors, Random and non-random sampling, different sampling techniques – simple random, stratified, systematic, cluster& multistage.	✓			10%	**LE,SE**
Unit III	**3 hours**	3. **Sampling distributions** 3.1 Parameter and Statistic. Standard error. Basic probability distributions - Normal, poisson, binomial distributions with their applications in biological sciences.	✓			5%	**SE**

Unit IV	**6 hours**	**4. Tests of significance** 4.1 Basics if testing of hypothesis – Null & Alternative hypothesis, type 1 and type II errors, level of significance (parametric) & power of the tests, p value, Confidence interval. Tests of significance – T test (paired &UN paired), Chi square test & Test of proportion, One way analysis of variance. Repeated measures analysis of variance. Tests of significance (non-parametric) – Mann – Whitney U Test, Wilcoxon Test, Kruskal – Wallis Analysis of variance, Friedmann's Analysis of variance	✓			15%	**LE,SE**

Unit V	**3 hours**	**5. Correlation and regression** 5.1 Linear correlation by Karl Pearson and rank order correlation due to Spearman, Testing the significance of correlation co efficient, simple linear regression – estimation & testing, residual plots, multiple linear regression.	✓			15%	**LE**
Unit VI	**2 hours**	**6. Sample size determination** **6.1** General concept. Sample size for estimating means and proportion, testing of difference in means and proportions of two groups.	✓			5%	**SE**
Unit VII	**2 hours**	**7. Study designs** 7.1 Epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods – case	✓			10%	**SE**

		control and cohort studies. Clinical trials / intervention studies, odds ratio and relative risk, stratified analysis					
Unit VIII	**2 hours**	**8. Multivariate analysis** 8.1 Concept of multivariate analysis, introduction to logistic regression and survival analysis	✓			15%	**LE,SE**
Unit IX	**1 hours**	**9. Reliability and validity of diagnostic tests** 9.1 Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), ROC curve.	✓			10%	**LE,SE**
Unit X	**1 hours**	**10. Format of scientific documentations**	✓			10%	**LE,SE**

		10.1 Structure of research protocols, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta-analysis.					

Recommended Books:

1. Rao NSN: Applied statistics in health sciences, JP publishers
2. Mahajan B.K: Methods of biostatistics, Kothari book depot, A.D Marg, Bombay
3. Potti L.R: A text book of statistics, Yamuna publications, Sreekanteshwaram,
4. Trivandrum.
5. Lancaster H.O: Introduction to medical statistics, Johnwiley & sons, New York.
6. Leius A.E: Biostatistics, Reinhold publishing Co, New York.
7. Cotton T: Statistics in medicine, Little Brown & Co, Boston.
8. Hill A.B: Principles of medical statistics, Oxford University press, New York

Course Title: Clinical Dialysis I

a. Practical I

Course: Core

Credits: 4 **No. of Hours: 120**

Course Outcomes:

At the end of the Course, the students will be able to

a. Perform the care for Vascular access, needling and independent handling of dialysis procedure.
b. Comprehend AVF and AVG needling techniques.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	40	**Dialyser reprocessing, maintenance of water treatment plant and conducting hemodialysis** 1.1 Dialyser reprocessing	✓			50%	-

		1.2. Water treatment plant	✓				
		1.3.Starting dialysis with catheters	✓				
		1.4.Dialysis prescription	✓				
		1.5.Dialysis initiation	✓				
		1.6.Parameter settings			✓		
		1.7.Dialysis termination	✓				
II	40	**Vascular access care, needling and independent handling of dialysis procedure** 2.1 Vascular access assessment and care	✓			25%	-
		2.2. AVF/AVG cannulation & techniques	✓				
		2.3. Fistula needle removal	✓				
		2.4. Dialysis unit maintenance record documentation	✓				
		2.5. Independent handling of dialysis procedure	✓				
III	40	**AVF and AVG needling technique**	✓			25%	-

b. Practical II

Course: Core

Credits: 5 **No. of Hours: 225**

Course Outcomes:

a. Monitoring the dialysis patients for intra dialytic complications.
b. Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.
c. Involve in the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts.

Course Content:

In the Practical II the student will get experience in various aspects in dialysis unit under the supervision of experienced professionals and is expected to work and contribute in the dialysis unit.

II Semester

Course Title: Renal Pharmacology

Course: Core

Credits: 3 No. of Hours: 45

Course Outcomes:

After completing this course the student will be able to:

a. Define the pharmacokinetics and pharmacodynamics of a drug.
b. Describe the commonly used medications used in renal failure.
c. Explain the IV fluid therapy in renal disease
d. Explain dose, duration and administration of drugs in dialysis patients.
e. Define anticoagulants
f. Explain erythropoietin in detail
g. Explain the use of hemodialysis solutions and chemicals

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	5	**General Pharmacological Principle** 1.1.Definitions, routes of drug administration			✓	5%	SE
		1.2.Pharmacokinetics			✓		
		1.3.Pharmacodynamics			✓		

		1.4.Adverse drug effects			✓		
II	10	**Medications commonly used by patient with renal failure** 2.1. Antacids and phosphate binders		✓		25%	SE
		2.2.Anti anemic drugs		✓			
		2.3.Anticoagulants		✓			
		2.4.Antihypertensives		✓			
		2.5.Antimicrobials		✓			
		2.6.Antipruritis		✓			
		2.7.Cardiovascular drugs		✓			
		2.8.Chelating agents		✓			
		2.9.Electrolytes		✓			
		2.10. Laxatives		✓			
		2.11. Local anesthetics		✓			
		2.12. Potassium ion exchange resin		✓			
		2.13. Thrombolytic agents		✓			
		2.14. Vitamins		✓			
III	30	**Pharmacology related to Renal disease, Hemodialysis and Peritoneal dialysis**	✓			70%	LE, SE

		3.1. IV fluid therapy with special emphasis in renal disease.					
		3.2. Diuretics – Classifications actions,	✓				
		3.3. Antihypertensive - Classification, action, dosage, side effects & contraindications, special reference during dialysis, vasopressors	✓				
		3.4. Drugs used in hypotension.	✓				
		3.5. Drugs & Dialysis – Dose & duration of administration of drugs	✓				
		3.6. Dialysable drugs – Phenobarbitone, Lithium, Methanol etc	✓				
		3.7. Vit D & its analogues, phosphate binders, iron, folic acid & other vitamins of	✓				

		therapeutic value					
		3.8. Erythropoietin in detail.	✓				
		3.9. Heparin including low molecular weight heparin	✓				
		3.10. Protamine sulphate.	✓				
		3.11. Gluteraldehyde, sodium hypochlorite, hydrogen peroxide role as disinfectants & adverse effects of residual particles applicable to glutaraldehyde	✓				
		3.12. Haemodialysis concentrates – composition & dilution (Acetate & bicarbonates)		✓			
		3.13. PD fluid in particular hypertonic solutions composition (Dextrose, icodextrin solutions)	✓				

		3.14. Potassium exchange resins with special emphasis on mode of administration.	✓				

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Bowman WC, Rand MJ. Textbook of pharmacology. Blackwell Scientific Publications.; 1980 Sep 20.
2. Tripathi KD. Essentials of medical pharmacology. JP Medical Ltd; 2013 Sep 30.
3. Whalen K. Lippincott illustrated reviews: pharmacology. Lippincott Williams &Wilkins; 2018 Aug 14.

Course Title: Nephrology & Kidney Disease

Course: Core

Credits: 3 No. of Hours: 45

Course Outcomes:

After completing this course the students will be able to:

a. Describe the clinical syndromes of renal diseases.
b. Describe the glomerular diseases.
c. Explain the disorders of acid-base and electrolyte disorders.
d. Define Hypertension in renal failure

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	5	**Patient Assessment** 1.1 Physical Diagnosis		✓		5%	SE
		1.2. Urinalysis		✓			
		1.3.Measurement of Glomerular Filtration Rate		✓			
		1.4.Measurement of Urinary Protein		✓			
		1.5.Renal Imaging Techniques		✓			

		1.6.Renal Biopsy		✓			
		1.7.Indications for Dialysis		✓			
		1.8.Drug Therapy in Renal Disease		✓			
II	5	**Clinical Syndromes** 2.1 Etiology, Pathophysiology, and Diagnosis of Acute Renal Failure	✓			15%	LE, SE
		2.2. Management of Acute Renal Failure	✓				
		2.3.Prerenal Azotemia	✓				
		2.4.Obstructive Uropathy	✓				
		2.5.Asymptomatic Proteinuria	✓				
		2.6.Asymptomatic Hematuria	✓				
		2.7.Acute Glomerulonephritis	✓				
		2.8.Rapidly progressive Glomerulonephritis	✓				
		2.9.Nephrotic Syndrome	✓				
		2.10. Nephrolithiasis	✓				
		2.11. Urinary Tract Infection		✓			
		2.12. Disorders of Tubular Function	✓				
III	5	**Primary Glomerular Disease**	✓			15%	LE, SE

		3.1 Minimal Change Disease					
		3.2.Focal Segmental Glumerulosclerosis	✓				
		3.3.Membranous glomerulopathy	✓				
		3.4.IgA Nephropathy	✓				
		3.5.Membranoproliferative Glomerulonephritis	✓				
IV	5	**Secondary Glomerulonephritis** 4.1 Diabetic Nephropathy	✓			10%	LE, SE
		4.2. Lupus nephritis	✓				
		4.3. Post infectious glomerulonephritis	✓				
		4.4. Hepatitis-Associated Glomerulonephritis		✓			
		4.5. HIV-Associated Renal Disorders		✓			
V	5	**Other parenchymal Renal Diseases** 5.1 Renal Dysplasia	✓			10%	LE, SE
		5.2. Cystic Diseases of the Kidneys	✓				
		5.3. Other hereditary Renal diseases	✓				
		5.4. Reflux Nephropathy	✓				

		5.5. Renal Vasculitis	✓				
		5.6. Other Vascular Renal Disorders	✓				
		5.7. Sickle Cell Nephropathy	✓				
		5.8. Renal Disease due to dysproteinemias	✓				
VI	5	**End-Stage Renal Diseases Causes and Consequences** 6.1. Epidemiology and outcomes of End-Stage Renal Disease	✓			10%	LE, SE
		6.2. Renal Osteodystrophy	✓				
		6.3. Uremic pericarditis	✓				
		6.4. Anemia Associated with Renal Failure	✓				
		6.5. Other manifestations of Uremia	✓				
VII	5	**End-Stage Renal Disease Management** 7.1 Technical Aspects of Hemodialysis	✓			20%	LE, SE
		7.2. Hemodialysis: Assessing Adequacy	✓				
		7.3. Complications of Hemodialysis	✓				
		7.4. Technical Aspects of Peritoneal Dialysis	✓				
		7.5. Complications of Peritoneal Dialysis	✓				
		7.6. Renal Transplantation: Epidemiology and outcomes	✓				

		7.7. Renal Transplantation: Donor and Recipient Evaluation	✓				
		7.8. Renal Transplantation: Classification and consequences of Rejection	✓				
		7.9. Renal Transplantation: Immunosuppression	✓				
		7.10. Complications of Renal Transplantation	✓				
VIII	5	**Hypertension** 8.1 Essential Hypertension	✓			10%	SE
		8.2. Renal parenchymal hypertension	✓				
		8.3. Renovascular Hypertension	✓				
		8.4. Pheochromocytoma	✓				
		8.5. Other Causes of Secondary Hypertension	✓				
		8.6. Hypertensive Emergencies	✓				
		8.7. Childhood Hypertension	✓				
IX	5	**Acid-Base and Electrolyte Disorders** 9.1. Metabolic Acidosis			✓	5%	SE
		9.2. Metabolic Alkalosis			✓		
		9.3. Respiratory Acidosis			✓		
		9.4. Respiratory Alkalosis			✓		
		9.5. Hyponatremia and Hypernatremia			✓		
		9.6. Hypokalemia and Hyperkalemia			✓		

		9.7. Hypocalcemia and Hypercalcemia			✓		
		9.8. Phosphorus			✓		
		9.9. Magnesium			✓		

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Gilbert S, Weiner DE. National Kidney Foundation Primer on Kidney Diseases E-Book.Elsevier Health Sciences; 2017 Sep 11.
2. Bomback AS, Bakris GL. Chronic kidney disease (CKD) and hypertension essentials.Jones & Bartlett Publishers; 2010 Jul 15.
3. Hansel DE, Kane CJ, Paner GP, Chang SS, editors. The kidney: a comprehensive guideto pathologic diagnosis and management. Springer; 2015 Dec 16.
4. Himmelfarb J, Sayegh MH. Chronic Kidney Disease, Dialysis, and Transplantation E-Book: A Companion to Brenner and Rector's The Kidney- Expert Consult: Online andPrint. Elsevier Health Sciences; 2010 Oct 22.

Course Title: Biomedical Instrumentation

Course: Core

Credits: 3 No. of Hours: 45

Course Outcomes:

After completing this course the student will be able to:

a. Explain the Sources of bioelectric potential
b. Describe the machine function and malfunction
c. Explain the medical safety of medical equipment

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	3	**Basic Transducer principles** 1.1 The transducer and transduction principles	✓			10%	LE, SE
		1.2. Active transducers	✓				
		1.3. Passive transducers for Biomedical applications	✓				
II	2	**Sources of Bioelectric potentials**	✓			15%	LE, SE

		2.1 Resting and action potentials					
		2.2. Propagation of Action potentials	✓				
		2.3. The Bioelectric potentials	✓				
III	2	**Electrodes** 3.1 Electrode theory	✓			10%	LE, SE
		3.2. Biopotential electrodes	✓				
		3.3. Biochemical transducers	✓				
IV	3	**The computer in Biomedical Instrumentation** 4.1 The digital computer - Computer Hardware, Computer software		✓		10%	SE
		4.2. Microprocessors - Types of microprocessors, Microprocessors in Biomedical Instrumentation- Calibration , Table lookup , Averaging , Formatting and printout		✓			
		4.3. Interfacing the computer and medical instrumentation and other equipment.- Digital interfacing requirement , Analog-to-digital and Digital-to-Analog conversion		✓			

		4.4. Biomedical computer application - Data acquisition, storage and retrieval, data reduction and transformation, mathematical operation, pattern recognition, limit detection, statistical analysis of data, data presentation control function - Computer analysis of the ECG, the digital computer in the clinical chemistry laboratory, digital computerized in hemodialysis machine, other computer application		✓			
V	5	**Electrical safety of Medical Equipment.** 5.1 Physiological effects of electrical current.		✓		10%	LE, SE
		5.2. Shock hazards from electrical equipment.	✓				
		5.3. Methods of accident prevention	✓				
		5.3.1. Grounding			✓		
		5.3.2. Double insulation			✓		
		5.3.3. Protection by low voltage			✓		
		5.3.4. Ground – fault circuit interrupter			✓		

		5.3.5. Isolation of patient – connected parts	✓				
		5.3.6. Isolated power distribution systems	✓				
VI	5	**Patient care and monitoring** 6.1. The elements of intensive – care monitoring	✓			10%	LE, SE
		6.2. Patient monitoring displays		✓			
		6.3. Diagnosis, calibration and repairability of patient – monitoring equipment	✓				
		6.3. Other instrumentation for monitoring patients			✓		
		6.4. The organization of the hospital for patient care monitoring	✓				
		6.5. Defibrillator	✓				
VII	5	**Description of Machine Functions and Malfunction** 7.1 Description of the T1Test			✓	10%	SE
					✓		
		7.2. Function description of the s			✓		
		7.3. Function description of the hydraulic unit			✓		
VIII	5	**Technical safety checks and maintenance** 8.1 General notes		✓		10%	SE

		8.2. Technical safety checks and maintenance procedures		✓			
		8.3. VDE test		✓			
		8.4. TSC and maintenance checklist		✓			
		8.5. Overview of the Dip switches		✓			
		8.6. Calibration mode		✓			
		8.7. Hydraulics		✓			
		8.8. Air Detector		✓			
IX	5	**Setup Menu** 9.1 Overview	✓			10%	SE
		9.2. Main menu	✓				
		9.3. Calibration Program	✓				
X	10	**Circuit diagram and circuit description** 10.1 Block diagram			✓	5%	SE
		10.2. Ac diagram			✓		
		10.3. Block diagram of voltage supply, Block diagram of screen Connection layout diagram			✓		
		10.4. P.C.B. LP 450 level detector control (LD)			✓		
		10.5. P.C.B. LP 493 BLD			✓		
		10.6. P.C.B. LP 624 Control board			✓		
		10.7. P.C.B. LP 630 Mother board			✓		

		10.8. P.C.B. LP 631 CPU 1			✓		
		10.9. P.C.B. LP 632 CPU 2			✓		
		10.10. P.C.B. LP 633 Input board			✓		
		10.11. P.C.B. LP 634 output board			✓		
		10.12. P.C.B. LP 635 Display board			✓		
		10.13. P.C.B. LP 636 external connectors			✓		
		10.14. P.C.B. LP 638 Power supply			✓		
		10.15. P.C.B. LP 639 Power logic			✓		
		10.16. P.C.B. LP 643.3 Control board (Hep)			✓		
		10.17. P.C.B. LP 644.3 Display board (Hep)			✓		
		10.18. P.C.B. LP 645 position sensor membrane pump			✓		
		10.19. P.C.B. LP 647 Power logic A			✓		
		10.20. P.C.B. LP 649 Display board			✓		
		10.21. P.C.B. LP 742 Interference filter			✓		
		10.22. P.C.B. LP 743 power control 2			✓		
		10.23. P.C.B. LP 744 Power control 1			✓		

		10.24. P.C.B. LP 747 Distribution board			✓		
		10.25. P.C.B. LP 748 Display board (BP)			✓		
		10.26. P.C.B. LP 758 COMMCO – II			✓		
		10.27. P.C.B. LP 763 Multi interface boarddd.			✓		
		10.28. P.C.B. LP 922 Display board			✓		
		10.29. P.C.B. LP 923Traffic light			✓		
		10.30. P.C.B. LP 924 Display board			✓		

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Bronzino JD. Biomedical Engineering Handbook 2. Springer Science & BusinessMedia; 2000 Feb 15.
2. Khandpur RS. Handbook of biomedical instrumentation. McGraw-Hill Education; 1987.
3. Webster JG, editor. Medical instrumentation: application and design. John Wiley & Sons; 2009 Feb 3.

Course Title: Bioethics

Course: Core

Credits: 3 **No. of Hours: 45**

Course Outcomes:

a. Locate the importance of bioethics in health care and research
b. Understand the ethical principles and theories
c. Identify ethical issues in healthcare setting and their possible solutions
d. Analyse the ethical issues in specific clinical settings
e. Apply ethical principles in clinical research
f. Locate the importance of healthcare provider- patient relationship

Course Content:

Unit	Hrs	Content	Must	Good to	Desirable	Weightage (%)	Type of Questions
I	5	**Introduction to bioethics** 1.1 Definition and scope of bioethics	✓			10	LE, SE
		1.2 History of bioethics		✓			
		1.3 Codes of ethics	✓				
II	5	**Ethical principles and theories** 2.1 The ethical	✓			30	LE, SE

		principles					
		2.2 Ethical theories and their	✓				
		2.3 Application of ethical theories and principles in healthcare	✓				
III	10	**Ethics in healthcare** 3.1 Consent	✓			20	LE, SE
		3.2 Risk: benefit analysis	✓				
		3.3 Distributive justice		✓			
		3.4 Privacy and confidentiality	✓				
		3.5 Stigma and discrimination		✓			
		3.6 Health technology assessment			✓		
		3.7 Public health ethics			✓		
IV	15	**Specific ethical issues in healthcare** 4.1 End of life care and euthanasia	✓			10	SE
		4.2 Artificial reproductive techniques			✓		
		4.3 Medical termination of pregnancy		✓			
		4.4 Pre-natal sex determination		✓			

		4.5 Organ donation		✓			
		4.6 Medical errors and truth telling	✓				
		4.7 Medical negligence and malpractice	✓				
V	10	**Research ethics** 5.1. Research ethics principles	✓			30	LE, SE
		5.2. Informed consent	✓				
		5.3. Vulnerability in research	✓				
		5.4. Responsible conduct of research	✓				
		5.5. Publication ethics	✓				

Recommended Books:

1. English DC. Bioethics a Clinical Guide for Medical Students.
2. Tayaoe M.C. Textbook of Medical Bioethics, Attitude and Communication for Medical Students; 2016 Feb 28
3. Princy Louis Palatty. A Textbook of Bioethics for Healthcare Professionals 1st Edition; 2018

Course Title: Clinical Dialysis II

a. Practical I

Course: Core

Credits: 4 **No. of Hours: 120 hrs**

Course Outcomes:

After completing this course the student will be able to:

a. Perform extracorporeal blood circuit priming procedures.
b. Brief on disinfectants used in dialysis unit and its adverse effects.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	60	**Disinfection** 1.1.Introduction		✓		25%	-
		1.2.Types of disinfectants used in dialysis & adverse effects	✓				
II	60	**Blood circuit priming and handling dialysis catheters** 2.1. Blood circuit priming	✓			75%	-

		2.2. Dialysis catheters handling-dressing and removal	✓				
		2.3. Preparation of disinfectants used in dialysis	✓				
		2.4. Identification of alarms and alarm reset	✓				

b. Practical II

Course: Core

Credits: 4 **No. of Hours: 180 hrs**

Course Outcomes:

a. Monitoring the dialysis patients for intra dialytic complications.
b. Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.
c. Involve in the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts.

Course Content:

In the Practical II the student will get experience in various aspects in dialysis unit under the supervision of experienced professionals and is expected to work and contribute in the dialysis unit.

III Semester

Course Title: Complications of Dialysis & Dialysis Equipment

Course: Core

Credits: 3 **No. of Hours: 45**

Course Outcomes:

After completing this course the student will be able to:

a. Explain the hemodialysis related complications
b. Describe the complications related to peritoneal dialysis
c. Explain the complications of hemoperfusion
d. Describe dialysis in seropositive
e. Explain the complications of dialysis in diabetic patients

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	10	**Procedure related complications and their management** **1.1 Hemodialysis related:** 1.1.1 Vascular access complications	✓			40%	LE, SE
		1.1.2. Complications related to water treatment plant	✓				
		1.1.3. Complications related to dialysis fluids	✓				

		1.1.4. Complications related to dialyzers	✓				
		1.1.5. Complications related to anticoagulation	✓				
		1.1.6. Complications related to adequacy	✓				
		1.1.7. Acute dialysis complications	✓				
		1.2 Peritoneal Dialysis related: 1.2.1 Complications related to peritoneal access	✓				
		1.2.2. Complications related peritoneum	✓				
		1.2.3. Complications related to adequacy	✓				
		1.2.4. Complications related to infection (Peritonitis)	✓				
		1.3 Continuous Renal Replacement Therapy 1.3.1 Complications related to anticoagulation	✓				
		1.3.2. Complications related to fluid management	✓				
		1.3.3. Complications related to solute removal	✓				
II	20	**Patient related complications and their management in dialysis (PD & HD) patients** 2.1 Cardiac diseases in dialysis patients	✓			40%	LE, SE

		2.2 Hematological problems		✓			
		2.3. Coagulation problems		✓			
		2.4. Bone diseases		✓			
		2.5. Acid – base disorders		✓			
		2.6. Infectious problems		✓			
		2.7. Immune disorders		✓			
		2.8. Nutritional complications (including CRRT)		✓			
		2.9. Endocrinal problems (adult & pediatric)		✓			
		2.10. Dermatological problems		✓			
		2.11. Hypertension		✓			
		2.12. Pulmonary problems		✓			
		2.13. Quality of life		✓			
		2.14. Neurological complications		✓			
		2.15. Psychiatric and psychosocial problems		✓			
		2.16. Gastrointestinal complications		✓			
		2.17. Ocular complications		✓			

III	15	**Special conditions** 3.1 Complications of hemoperfusion	✓			20%	LE, SE
		3.2. ICU renal replacement therapy related complications	✓				
		3.3. Complications related to pediatric dialysis (acute & chronic dialysis)	✓				
		3.4. Dialysis in seropositive patients	✓				
		3.5. Complications in diabetic patients	✓				
		3.6.Complications related plasmapheresis	✓				
		3.7.Aspect – impact related to dialysis]	✓				

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Nissenson AR, Fine RE. Handbook of Dialysis Therapy E-Book. Elsevier HealthSciences; 2016 Oct 24.
2. Levy J, Brown E, Lawrence A. Oxford handbook of dialysis. Oxford University
1. Press;2016 Feb 18.
2. Daugirdas JT, Blake PG, Ing TS. Handbook of dialysis. Lippincott Williams & Wilkins;2012 Feb 20.
3. Drukker W, Parsons FM, Maher JF, editors. Replacement of renal function by dialysis:a textbook of dialysis. Springer Science & Business Media; 2012 Dec 6.

YENEPOYA
(DEEMED TO BE UNIVERSITY)

Course Title: Nutrition & Quality Assurance in Dialysis

Course: Core

Credits: 3 No. of Hours: 45

Course Outcomes:

After completing this course the student will be able to:

a. Describe the various aspects of nutrition, nutritional assessments and recommended dietaryallowance.
b. Elaborate quality assurance in dialysis equipment's.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	5	**Nutrition** 1.1 Energy (Calories)			✓	10%	SE
		1.2. Protein			✓		
		1.3. Lipid (Fats& Cholesterol)			✓		
		1.4. Carbohydrates			✓		
		1.5. Thiamine vitamin B1, aneurine			✓		
		1.6. Riboflavin			✓		
		1.7. Vitamin B6 (pyridoxine, adermin)			✓		

		1.8. Nicotinic acid (Niacin, nicotinamide)			✓		
		1.9. Folic acid (folate, folacin, pteroylglutamic acid)			✓		
		1.10. Vitamin b12 (cobalamin)			✓		
		1.11. Pantothenic acid(filtrate factor)			✓		
		1.12. Choline, biotin			✓		
		1.13. Ascorbic acid (vitamin C)			✓		
		1.14. Vitamin A			✓		
		1.15. Vitamin D			✓		
		1.16. Vitamin E			✓		
		1.17. Vitamin K			✓		
		1.18. Bioflavonoid (vitamin P)			✓		
		1.19. Sodium			✓		
		1.20. Potassium			✓		
		1.21. Iron			✓		
		1.22. Calcium			✓		
		1.23. Phosphate			✓		
		1.24. Magnesium			✓		

		1.25. Manganese			✓		
		1.26. Iodine			✓		
		1.27. Copper			✓		
		1.28. Cobalt			✓		
		1.29. Chloride			✓		
		1.30. Fluoride			✓		
		1.31. Trace elements			✓		
		1.32. Dietary Fibers			✓		
		1.33. Water			✓		
II	5	**Food** 2.1 Wheat		✓		10%	SE
		2.2 Rice		✓			
		2.3 Pulses		✓			
		2.4 Soya beans		✓			
		2.5 Maize		✓			
		2.6 Millets		✓			
		2.7 Milk		✓			
		2.8 Egg		✓			
		2.9 Meats		✓			
		2.10 Nuts & Dried Fruits		✓			
		2.11 Sweet foods & sweetening agents		✓			
		2.12 Fish		✓			

		2.13 Vegetables		✓			
		2.14 Fruits		✓			
		2.15 Spices		✓			
		2.16 Beverage		✓			
		2.17 Alcohol		✓			
III	5	**Clinical Dietetics** 3.1 Diet Prescription	✓			10%	SE
		2 Peptic ulcer	✓				
		3 Flatulence	✓				
		4 Constipation	✓				
		5 Diarrhea& dysentery	✓				
		6 Malabsorption syndrome	✓				
		7 Inflammatory bowel disease	✓				
		8 Liver disease	✓				
		9 Jaundice	✓				
		10 Hepatic Coma	✓				
		11 Cirrhosis of liver	✓				
		12 Fatty liver	✓				
		13 Protein- Energy malnutrition	✓				
		14 Gallstone Diseases	✓				
		15 Anemic	✓				

		16 Under weight	✓				
		17 Obesity	✓				
		18 Diabetes mellitus	✓				
		19 Gout	✓				
		20 Kidney disease	✓				
		21 Renal failure	✓				
		22 Kidney stones	✓				
		23 Coronary Heart Diseases and atherosclerosis	✓				
		24 High BP	✓				
		25 Congestive cardiac failure	✓				
		26 Acid and alkaline foods	✓				
		27 Tube feeding	✓				
		28 Parenteral nutrition	✓				
		29 Pregnancy and lactation	✓				
		30 Diet for children	✓				
		31 Diet in old age	✓				
		32 Diet for athletes	✓				
IV	10	**Principles of Nutritional Assessment** **4.1. Introduction** 4.1.1. Nutritional	✓			20%	LE, SE

		assessment system					
		4.1.2. Methods used in nutritional assessment	✓				
		4.1.3. The design of nutritional assessment system	✓				
		4.1.4. Evaluation of nutritional assessment indices	✓				
		4.1.5. Reference distribution	✓				
		4.1.6. Reference limits	✓				
		4.1.7. Cutoff points	✓				
		4.2. Food consumption of Individual 4.2.1. Methods	✓				
		4.2.2. New development in measuring food consumption	✓				
		4.2.3. Selecting an appropriate method	✓				
		4.2.4. Summary	✓				
		4.3. Evaluation of nutrient intake data 4.3.1. Tables of recommended nutrient intakes	✓				
		4.3.2. Evaluating Nutrient intakes of individuals	✓				
		4.3.3. Evaluating the	✓				

		nutrient intakes of population groups					
		4.3.4. Probability approach to evaluating nutrient intakes	✓				
		4.4. Anthropometric assessment 4.4.1. Advantages and limitations of anthropometric assessment	✓				
		4.4.2. Sources of error in nutritional anthropometry	✓				
		4.4.3. Evaluation of anthropometric indices	✓				
		4.5. Anthropometric assessment of growth 4.5.1. Growth measurement	✓				
		4.5.2. Indices derived from growth measurements	✓				
		4.6. Anthropometric assessment of body composition 4.6.1. Assessment of body fat	✓				
		4.6.2. Assessment of fat-free mass	✓				
		4.7. Laboratory assessment of body composition	✓				

		4.7.1. Chemical analysis of cadavers					
		4.7.2. Total body potassium using 40 K	✓				
		4.7.3. Total body water using isotope dilution	✓				
		4.7.4. Other body fluid compartments using isotope dilution	✓				
		4.7.5. Total body nitrogen	✓				
		4.7.6. Densitometry	✓				
		4.7.7. Other laboratory method for determining body composition	✓				
		4.8. Laboratory assessment 4.8.1. Static biochemical tests Functional tests	✓				
		4.8.2. Selection of laboratory tests	✓				
		4.8.3. Evaluation of laboratory indices	✓				
		4.9. Assessment of protein status: 4.9.1. Assessment of somatic protein status	✓				
		4.9.2. Assessment of visceral protein status	✓				
		4.9.3. Metabolic changes as indices of	✓				

		protein status					
		4.9.4. Muscle function tests	✓				
		4.9.5. Immunological tests	✓				
		4.10. Assessment of iron status 4.10.1. Hemoglobin	✓				
		4.10.2. Hematocrit	✓				
		4.10.3. Red cell indices	✓				
		4.10.4. Serum iron, TIBC and transferring saturation	✓				
		4.10.5. Serum ferritin	✓				
		4.10.6. Erythrocyte protoporphyin	✓				
		4.10.7. Multiparameter indices	✓				
		4.11. Assessment of status of thiamin, riboflavin and niacin 4.11.1. Assessment of thiamin status	✓				
		4.11.2. Assessment of riboflavin status	✓				
		4.11.3. Assessment of niacin status	✓				
		4.12. Assessment of the status of folate and vitamin B12 4.12.1. Assessment of	✓				

		folate status					
		4.12.2. Assessment of vitamin B12 status	✓				
		4.13. Assessment of the status of calcium, phosphorus and magnesium 4.13.1. Assessment of calcium status	✓				
		4.13.2. Assessment of phosphorus status	✓				
		4.13.3. Assessment of magnesium status	✓				
		4.14. Clinical assessment 4.14.1. Medical history	✓				
		4.14.2. Physical examination	✓				
		4.14.3. Nutritional assessment of hospital patients	✓				
		4.14.4. Methods based on single indices	✓				
		4.14.5. Prognostic nutritional indices	✓				
		4.14.6. Hospital prognostic indices	✓				
		4.14.7. Cluster analysis	✓				
		4.14.8. Subjective global assessment the prognostic value of nutritional assessment	✓				

		indices					
V	20	**QUALITY ASSURANCE** 5.1 Basics of quality assurance	✓			50%	LE, SE
		2 Quality assurance for water treatment plant	✓				
		3 Quality assurance for dialysis delivery system	✓				
		4 Quality assurance for dialysate and dialysate concentrate	✓				
		5 Quality assurance for dialyzers	✓				
		6 Ancillary devices and equipment-quality assurance	✓				
		7 Quality assurance for anticoagulation	✓				
		8 Quality assurance for vascular access devices	✓				
		9 Quality assurance for hemodialyzer reuse	✓				
		10 Infection control-Quality assurance	✓				
		11 Handling of toxic chemicals	✓				

		12 Medical device reporting	✓				

LE – Long Essay, SE – Short Essay

Recommended Books:

1 Mitch WE, Ikizler TA, editors. Handbook of Nutrition and the Kidney. Lippincott Williams & Wilkins; 2010.

2 Kopple JD, Massry SG, editors. Kopple and Massry's nutritional management of renal disease. Lippincott Williams & Wilkins; 2004.

3 Nissenson AR, Fine RE. Handbook of Dialysis Therapy E-Book. Elsevier Health Sciences; 2016 Oct 24.

4 Levy J, Brown E, Lawrence A. Oxford handbook of dialysis. Oxford University Press; 2016 Feb 18.

5 Daugirdas JT, Blake PG, Ing TS. Handbook of dialysis. Lippincott Williams & Wilkins;2012 Feb 20.

6 Drukker W, Parsons FM, Maher JF, editors. Replacement of renal function by dialysis: a textbook of dialysis. Springer Science & Business Media; 2012 Dec 6

Course Title: Healthcare Management

Course: Core

Credits: 3 **No. of Hours: 45**

Course Outcomes:

a. Concepts of Hospitals – The student will gain knowledge about hospital administration & planning.

b. Workflow in hospitals - Enumerate and identify various Clinical Services like OPD, IPD, ward Management, OT, Emergency, disaster Management and ICU.

c. Organizational Structures - To learn to meet special challenges posed by human behavior in workplace of 21st century

d. Quality management - To create an awareness about the process of applying for and implementing various accreditation process in healthcare facilities.

Course Content:

Unit	Hrs	Content	Must	Good to	Desirabl	Weightage	Type of Questions
I	4	**Hospital Structure** 1.1. Introduction to Hospitals, Healthcare & Medical Care, Rationale of Hospital Administration	✓			5%	SE
		1.2. History of Hospitals, Public Health Delivery system in India, Types of Hospitals, Voluntary Health Organizations			✓		

II	8	**Management of Healthcare Organizations** 2.1 Introduction to Management	✓			20%	LE, SE
		2.2 Evolution & Theories of Management		✓			
		2.3 Management Functions: Planning	✓				
		2.4 Organizing	✓				
		2.5 Controlling	✓				
		2.6 Decision Making	✓				
		2.7 Staffing	✓				
		2.8 Techniques in Management	✓				
III	7	**Organizational Behavior** 3.1 The Importance of Interpersonal Skills, Scope & Process of OB Structure & theories	✓			15%	LE, SE
		3.2 Motivation - Abraham Maslow's hierarchy of needs theory, Theory X & Y. Contemporary theories of motivation.	✓				
		3.3 Foundations of Group Behavior – Formal Vs Informal, Social Identity Theory		✓			

		3.4 Organizational Culture		✓			
		3.5 Communications in an Organization	✓				
IV	7	**Management and Health Economics** 4.1 Demand & Supply	✓			20%	LE, SE
		4.2 Nature of Costs	✓				
		4.3 Marginal cost and breakeven analysis	✓				
		4.4 Market structure: Business & Government, Role of Government	✓				
V	7	**Accounting for Hospital Management** 5.1 Budgeting & Budgetary control - Classification of budget, P & L, Balance Sheets	✓			20%	LE, SE
		5.2 Types of Accounts, Debit & Credit	✓				
		5.3 Financial Statement Analysis	✓				
VI	7	**Concept of Hospital** 6.1 Departmentation in Hospital	✓			10%	SE

		6.2 Outpatient, Inpatient Services	✓				
		6.3 Intensive Care Unit, Emergency Services	✓				
		6.4 Laboratory, Radiology	✓				
		6.5 Organizing of support services, Utility Services	✓				
		6.6 Evaluation of Hospital services – Hospital Statistics	✓				
		6.7 Hospital Information Systems - Issues related to Healthcare technology, Planning, Infrastructure	✓				
VII	5	**Evolution of Quality management** 7.1 Quality Management Tools & methods	✓			10%	SE
		7.2 Quality certification & Accreditation – NABH, NABL	✓				

Text book/ Recommended Books:

1 Prasad LM. Principles and practice of management. Sultan Chand & Sons; 2020 Oct 1

2 Robbins SP, Judge TA, Vohra N. Organizational behaviour by pearson 18e. Pearson Education India; 2019.

3 Sakharkar B. M. Hospital planning & administration. Jaypee Brothers Medical Publishers Pvt. Limited, 2008 Dec 1.

4 Francis CM, De Souza MC. Hospital administration. Jaypee Brothers Medical Publishers; 2000.

5 Kulkarni GR, Satyashanker P, Anil Gomes L. Financial management for hospital administration. Jaypee Brothers Medical Publishers Pvt. Limited, 2009

Course Title: Clinical Dialysis III

a. Practical I

Course: Core

Credits: 4 **No. of Hours: 120**

Course Outcomes:

After completing this course the student will be able to:

a. Define dialysis unit procedures and patient assessment.
b. Perform patient monitoring during dialysis and patientcare record documentation.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	60	**Introduction to dialysis unit, dialysis unit procedures and patient assessment** 1.1. Infection control	✓			40%	
		1.2 Dialysis unit design	✓				
		1.3. Aseptic techniques	✓				
		1.4. Vital signs			✓		
		1.5. Patient approach & assessment		✓			

		1.6. Assisting dialysis room procedures		✓			
		1.7. Preparation of dialysate			✓		
II	60	**Patient monitoring during dialysis & patient care record sheet documentation** 2.1 Importance of monitoring		✓		60%	
		2.2. Identification of sick patients	✓				
		2.3. Hyperkalemia	✓				
		2.4. Pericarditis	✓				
		2.5. Metabolic acidosis	✓				
		2.6. Sepsis patients	✓				
		2.7. Patients with cardiac problem	✓				
		2.8. Bleeding	✓				
		2.9. Cardiac arrest	✓				

b. Practical II

Course: Core

Credits: 5 **No. of Hours: 225**

Course Objectives:

a. Monitoring the dialysis patients for intra dialytic complications.
b. Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.
c. Involve in the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts.

Course Content:

In the Practical II the student will get experience in various aspects in dialysis unit under the supervision of experienced professionals and is expected to work and contribute in the dialysis unit.

IV Semester

Course Title: Recent Advances in Dialysis and Nephrology

Course: Core

Credits: 3 **No. of Hours: 45**

Course Outcomes:

After completing this course the student will be able to:

a. Discuss the clinical consideration and evaluation of renal diseases and dialysis patients. To explore knowledge on recent advances in dialysis therapy
b. Define pediatric dialysis

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	20	**Pediatric Dialysis** 1.1 Pediatric HD - Introduction, HD in ARF causes of ARF in children, Indication for Dialysis, principles of Dialysis in ARF, HD in acute poisonings, HD for inborn errors of metabolism, acute vascular assess.	✓			40%	LE, SE
		1.2.Chronic HD- incidence and	✓				

		etiology of terminal renal failure in pediatric population, patient selection, facilities for treatment, indication for dialysis technical aspects of pediatric HD , vascular access, AV fistula, bridge grafts, catheters, complication of vascular access, HD equipment.					
		1.3.Methods of Pediatric Dialysis: - Common problem associated with long term HD, preparation of a child for eventual kidney Transplantation.	✓				
		1.4. PD - Peritoneal dialysis kinetics in children, catheter placement, PD in ARF, APD for reasons others than ARF, PD in CRF,	✓				

		Intermittent PD, Continuous PD, CAPD, CCPD, PD in small infants, complication of PD, supplemental therapy, the future of PD in children, transplantation of patients on PD.					
		1.5.Nutritional Management of Pediatric patients on chronic Dialysis: Introduction, Nutritional Assessment, Anthropometrics parameters, Biochemical assessment, Radiological assessment, Dietary recommendations, Energy requirements, protein require, Lipid require, sodium, Potassium, water, renal		✓			

		osteodystrophy, Vitamin D therapy, vitamins, Trace elements: Iron, Zinc and Copper, Nutritional considerations for the infant receiving CAPD or CCPD treatment.					
		1.6.Psychosocial problems related to dialysis in pediatric patients: Introduction, Adjustment, compliance, neuropsychological development, and rehabilitation.		✓			
		1.7.Pediatric CAV Hemofiltration: Pediatric operational principles of CAVH, characteristics of available hemofilters, practical operational details,			✓		

		clinical experience in the neonate, clinical experience in older children, conclusion.					
		1.8.Transplantation in infancy:- Introduction, indications for renal replacement therapy in infancy, renal failure in infancy, growth in infants with renal failure,		✓			
		1.9.Neurologic development in infants with renal failure, dialysis in infants, PD in infancy, complication of PD in infancy, immunologic effects of PD in the infant hemodialysis in infancy, Renal transplantation in infancy, preparation for infant transplant, post	✓				

		transplantation complication, immunosuppression protocols, identification and treatment of allograft rejection, growth post-transplant in the infant, cost and (RE) hospitalization in the infant with ESRD, Summary					
		1.10. Management of common Electrolyte Disorders in children.	✓				
		1.11. Clinical Care Coordinator: The Pediatric Nephrology Technologist of the Future.			✓		
II	10	**Clinical considerations in the Evaluation of Dialysis Patients** 2.1 Hypertension in Dialysis Patients	✓			25%	LE, SE
		2.2. Left Ventricular Dysfunction in Dialysis Subjects	✓				

		2.3. Coronary Artery Disease in End-Stage Renal Disease	✓				
		2.4. Autonomic Function and hemodynamic stability in End- Stage Renal Disease Patients	✓				
		2.5. Infection and immunity in End-stage Renal Disease	✓				
		2.6. B2-Microglobulin-Associated Amyloidosis of End-Stage Renal Disease	✓				
		2.7. Renal Osteodystrophy	✓				
		2.8. Dyslipidemias of End-Stage Renal Disease	✓				
		2.9. Selection of Therapy for Patients with End-stage Renal Disease	✓				
		2.10.Malnutrition and Intradialytic Parenteral Nutrition in ESRD Subjects	✓				
		2.11.Disorders of Hemostasis in Dialysis Patients	✓				

		2.12.Treatment of Anemia in Dialysis Subjects	✓				
		2.13.Acquired Cystic Kidney Disease	✓				
		2.14.Geriatric Dialysis Patients	✓				
		2.15.Diabetic Dialysis Patients	✓				
		2.16.Hemodialysis and Hemoperfusion for poisoning	✓				
		2.17.Dialysis considerations in the patient with Acute Renal Failure	✓				
		2.18.Infections in patients on Continuous Ambulatory Peritoneal Dialysis	✓				
		2.19.Balancing outcomes in Dialysis with Economic Realities	✓				
III	10	**Recent Advance in Dialysis and Nephrology**	✓			25%	LE, SE
IV	5	**Cyber Nephrology**		✓		10%	SE

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Nissenson AR, Fine RE. Handbook of Dialysis Therapy E-Book. Elsevier Health Sciences; 2016 Oct 24.
2. Sethi SK, Raina R, McCulloch M, Bunchman TE, editors. Critical Care Pediatric Nephrology and Dialysis: A Practical Handbook. Springer Singapore; 2019 Feb 1.
3. Deep A, Goldstein SL, editors. Critical Care Nephrology and Renal Replacement Therapy in Children. Springer; 2018 Aug 17.

Course Title: Psychosocial Issues & Rehabilitation in Dialysis Patient

Course: Core

Credits: 3 **No. of Hours: 45**

Course Outcome:

After completing this course the student will be able to:

a. Discuss the psychosocial issues, care and rehabilitation in dialysis patients.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	10	**Psychosocial issues in renal failure** 1.1 Psychosocial issues in ESRD	✓			30%	LE, SE
		1.2. Psychiatric fitness for Transplantation	✓				
II	20	**Care and rehabilitation of dialysis patients** 2.1 CKD Management programs and patient education	✓			25%	LE, SE
		2.2. Approach to CKD patients for slowing progression of CKD and of cardiovascular	✓				

		disease					
		2.3. General issues related to care of patients preparing for dialysis and chronic dialysis patients	✓				
		2.4. Quality life and rehabilitation in dialysis patients	✓				
		2.5. Quality of life in CKD- Management of CKD	✓				
		2.6. Conservative / palliative treatment and end of life care in CKD	✓				
		2.7. Pain management in CKD	✓				
III	10	**Nursing in renal disease** 3.1 Medical issues in dialysis		✓		25%	LE, SE
		3.2. Improving outcomes in dialysis patients	✓				
		3.3. Care of HIV dialysis patients		✓			
		3.4. Preparing CKD patient for dialysis- Management of CKD	✓				
IV	5	**Physical activity and endurance exercise training in hemodialysis patients**			✓	20%	SE

		4.1. Physical functioning definition and assessment					
		4.2. Physical functioning in dialysis patients			✓		
		4.3. Physiotherapy in hemodialysis patients			✓		
		4.4. Ethical consideration in dialysis patients	✓				

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Nissenson AR, Fine RE. Handbook of Dialysis Therapy E-Book. Elsevier Health Sciences; 2016 Oct 24.
2. Levy J, Brown E, Lawrence A. Oxford handbook of dialysis. Oxford University Press; 2016 Feb 18.
3. Daugirdas JT, Blake PG, Ing TS. Handbook of dialysis. Lippincott Williams & Wilkins; 2012 Feb 20.
4. Drukker W, Parsons FM, Maher JF, editors. Replacement of renal function by dialysis: a textbook of dialysis. Springer Science & Business Media; 2012 Dec 6.

Course Title: Renal Transplantation

Course: Core

Credits: 3 **No. of Hours: 45**

Course Outcome:

After completing this course the student will be able to:

a. Elaborate renal transplantation and transplant immunology

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	2	**History of Transplantation**			✓	5%	SE
II	2	**Characteristics of the allogenic immune response**	✓			5%	SE
III	2	**Tolerance and immunity:** 3.1 Self – Non-self-discrimination	✓			5%	LE, SE
		3.2. Antigen recognition	✓				
		3.3.Immune tolerance	✓				
IV	3	**Transplantation antigens :** 4.1 ABO, Monocyte and	✓			5%	LE, SE

		Endothelial cells Ag					
		4.2. Major + Minor Histocompatibility Ag	✓				
V	3	**Major Histocompatibility Complex** 5.1 HLA GI and HLA GII	✓			5%	LE, SE
		5.2. Nature of Allorecognition	✓				
		5.3. Inheritance of HLA	✓				
VI	5	**Tissue typing** 6.1 HLA typing, Short term vs long term/ quality of typing	✓			5%	LE, SE
		6.2. Matching for split Ages, relative strengths of HLS cocci	✓				
		6.3. Effects of blood transfusion	✓				
VII	5	**Regulation of the Immune response** 7.1 Role of Ag prescribing cell.	✓			10%	LE, SE
		7.2. T Cell receptor recognition of Ag	✓				
		7.3. CD4/CD8 cells subsets	✓				
		7.4. Accessory molecules	✓				
		7.5. T Cell activation	✓				
		7.6. T Cell energy	✓				

		7.7. Lymphokines and lymphokine receptors	✓				
		7.8. Th1 + Th2 cell subsets	✓				
VII	5	**Graft rejection** 8.1.Hyperacute / acute/ accelerated/chronic	✓			20%	LE, SE
		8.2.Mechanisms – Ab mediated/T cell mediated/ Delayed Type/ hypersensitivity mediated NK cell mediated.	✓				
		8.3.Mechanisms of Immunosuppression – Corticosteroids/ Azathioprine/FK506/ Rapamycin/Polyclonal immuno Globulins/Mab	✓				
		8.4.Donor specific immune tolerance/ Tolerance induction by blockade of co stimulation	✓				
		8.5.Evaluation of the donor + recipient – special issued + consideration prior kidney Transplantation /Age/Diabetes mellitus/Cardiovascular disease/	✓				

		infections/Malignant neoplasms / metabolic bone disease GI disease/ pulmonary/ urologic evaluation/ systemic disease /psychiatric problems/ vascular disease.					
		8.6.Immunological evaluation of the Transplant recipient – typing + Ag matching	✓				
		8.7.Screening of Humoral sensitization	✓				
IX	4	**Cross matching – techniques** 9.1. ABO Blood group matching/ family testing to determine haplotypes/ Cellular assays for HLA testing/ Analysis of survival data		✓		10%	SE
X	4	**Kidney donation – live donation – non related / related donors, cadaver** 10.1. Cadaver organ harvesting and preservation	✓			10%	LE, SE
		10.2. Kidney preservation – solutions	✓				
XI	4	**Transplant surgery + potential complications – Pre - OP care/Surgical**	✓			5%	LE, SE

		technique, postOP management/ potential complications.					
XII	2	**Immunosuppressive therapy – Induction protocols/ maintenance protocols.** 12.1. AZA/ Steroids/ CSA – Pharmacology – drug interactions	✓			5%	LE, SE
XIII	4	**Antirejection therapy – Pulse corticosteroids / ALS / OKT3** 13.1. Clinical Approach to Allograft dysfunction – ATN/ CSA/hyperacute rejection	✓			10%	LE, SE
		13.2. Ace or Acute rejection / other causes of DGF/ late chronic dysfunction.	✓				
		13.3. Pathological diagnosis of Allograft dysfunction	✓				
		13.4. Recurrent Glomerulonephritis	✓				
		13.5. De-novo injury	✓				
		13.6. Medical complications – Infections disease – Time table – viral infections – CMV/EBV	✓				

		13.7. Bacterial Infection– UTI – Opp. Bact. Infections/ Fungal Infection	✓				
		13.8. Cardiovascular disease – HT	✓				
		13.9. Lipid disorders	✓				
		13.10. Liver disease – HBV/HCV	✓				
		13.11. Malignancy	✓				
		13.12. Diabetes Mellitus, hematological problems	✓				
		13.13. Pancreatic – Kidney transplantation	✓				
		13.14. Pediatric transplantation – problems.	✓				

LE – Long Essay, SE – Short Essay

Recommended Books:

1. Danovitch GM, editor. Handbook of kidney transplantation. Lippincott Williams & Wilkins; 2009 Oct 1.
2. Morris P, Knechtle SJ. Kidney transplantation: principles and practice. Elsevier Health Sciences; 2008 Jun 30.
3. Chatterjee SN. Manual of renal transplantation. Springer Science & Business Media; 2012 Dec 6.

Course Title: Clinical Dialysis IV

a. Practical I

Course: Core

Credits: 4 **No. of Hours: 120 hours**

Course Outcomes:

After completing this course the student will be able to:

a. Describe extracorporeal blood therapies and ICU dialysis.

b. Explain hemodialysis procedure pre-setup.

c. Describe the different types of Dialysis Catheters.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
I	40	**Extracorporeal blood therapies and ICU dialysis** 1.1. Exposure to special extracorporeal blood therapies	✓			20%	
		1.2. Individual handling of ICU dialysis cases, Saline dialysis and SLED	✓				

		1.3. Counselling		✓			
		1.4. Hemodialysis procedure demonstration	✓				
II	20	**Dialysis catheters** 2.1 Types, design	✓			20%	
		2.2. Catheter care	✓				
		2.3. Starting dialysis with catheters	✓				
III	60	**Patient monitoring and HD procedure pre setup** 3.1 Patient monitoring during dialysis	✓			60%	
		3.2. Preparation of extracorporeal blood circuit			✓		
		3.3. Dialysis preset up		✓			
		3.4.Handling cardiac monitors, infusion pumps and ABG machine	✓				
		3.5.Method of documentation	✓				

b. Practical II

Course: Core

Credits: 4 **No. of Hours: 180 hours**

Course Outcomes:

a. Monitoring the dialysis patients for intra dialytic complications.
b. Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.
c. Involve in the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts.

Course Content:

In the Practical II the student will get experience in various aspects in dialysis unit under the supervision of experienced professionals and is expected to work and contribute in the dialysis unit.

10. Teaching - Learning methods

Teaching - Learning method	Courses
Experiential learning	Clinical Dialysis I – IV
Integrated/Inter-disciplinary learning	Bioethics, Healthcare Management
Participatory learning	Bioethics, Health Care Management, Psychosocial Issues & Rehabilitation in Dialysis Patients, Recent Advances in Dialysis & Nephrology, Biomedical Instrumentation
Problem-solving methodologies	Biostatistics & Research Methodology, Complications of Dialysis & Dialysis Equipment, Clinical Dialysis I–IV
Self-directed learning	Coursera / SWAYAM, Recent Advances in Dialysis & Nephrology, Renal Transplantation, Biomedical Instrumentation
Patient-centric and Evidence-based learning	Clinical Dialysis I–IV, Nutrition & Quality Assurance in Dialysis, Psychosocial Issues & Rehabilitation in Dialysis Patients
The Humanities	Bioethics, Psychosocial Issues & Rehabilitation in Dialysis Patients
Project-based learning	Dissertation, Biostatistics & Research Methodology

Teaching - Learning method	Courses
Team-work	Clinical Dialysis I–IV
Role-play	Bioethics, Health Care Management, Psychosocial Issues & Rehabilitation in Dialysis Patients
Reflective writing	Clinical Dialysis I–IV, Psychosocial Issues & Rehabilitation in Dialysis Patients

11. Scheme of Examination

11.1. Continuous Internal assessment format (distribution of marks)

Continuous Internal assessment components	Maximum marks
Average of two IA tests	20
Case Studies/Seminar/Assignments/Quizzes etc.	30
Total marks	50

11.2. Question Paper Pattern

Subjects having maximum marks = 50				Duration
Type of question	Number of questions	Marks for each question	Total	150 min
Long essay type	02	15	30	
Short essay Type	02	10	20	
Total			50	

11.3. Practical Examination

SI.NO	Components	Marks
1	Spotters	10
2	Case Scenario/OSCE/OSPE	20
3	Viva Voce	20
Total Marks		50

11.4. Particulars of practical, viva-voce & dissertation

11.4.1. Practical examination will be aimed at examination of clinical skills and competence of the candidates for undertaking independent work as a specialist.

11.4.2. Viva-Voce examination shall aim at assessing depth of knowledge, logical reasoning, confidence &oral communication skills.

11.4.3. Special emphasis shall be given to dissertation work during the M.Sc. Renal Dialysis Technology 2nd year examination.

11.4.4. The marks of Viva-Voce examination shall be included in the clinical examination to calculate the percentage and declaration of results.

11.4.5. OSCE/OSPE-shall have minimum of 5 stations.

11.5. Evaluation and Certification of online courses:

11.5.1. Evaluation will be based on predefined norms and parameters and announced in the overview of the Course at the time of offering the course. Formative continuous online assessments and end of course proctored exams shall be completed by the student.

11.5.2. The certificate obtained shall be submitted to the college office which will be communicated to the office of the Controller of Examinations of Yenepoya (Deemed to be University).

11.5.3. The Yenepoya (Deemed to be) University will give the equivalent credit weightage to the students for the credits earned through online learning courses through MOOCS/Coursera as per the credit plan of the program.

11.6. Credit Mobility of Online Courses:

11.6.1. The Yenepoya (Deemed to be University) will give the equivalent credit weightage to the students for the credits earned through online learning courses as per the credit plan of the program.

11.6.2. In case a student fails to complete the online course he/ she may be allowed to complete the course requirements by registering for another online course in subsequent semester or opt for a course offered at Yenepoya (Deemed to be University), provided such a course is offered during that semester.

11.6.3. The elective course offered by the Yenepoya (Deemed to be University) shall be restricted to a maximum of 3 credits.

11.6.4. A candidate shall compulsorily complete total 6 Credits of Multidisciplinary courses.

11.6.5. These courses shall be selected either from the Generic Electives offered by the Yenepoya (Deemed to be) university or from the SWAYAM/Coursera courses. A Candidate shall have freedom to choose the courses of once own choice and learn at their own pace but, require to complete minimum 3 credits before second semester and 6 credits before third semester SEE.

11.6.6. A candidate who wishes to earn additional credits may be permitted to do so during the academic duration.

11.7. Continuous Internal Assessment Components of PG Dissertation

Sl. No	Parameters		Marks
1.	Maintaining the timeline		10
2.	Presentation a Conference /CME/Publication (student can choose any of the criteria to avail 40 marks)		40
	Criteria	Marks Allocated	
	Online Oral/Online Poster/Offline Poster presentation/Conference proceeding publications in Scopus/WoS indexed journals/Publication of Copyright	20	
	Offline oral presentation at National/International Conference/Patents/Publication of Review Paper/Pilot Study/Study Protocol in Indexed Journal	40	
3.	Manuscript submission (Based on the dissertation) to the Indexed journals (SCOPUS/WoS) along with submission of final dissertation		50
	Total		**100**

11.8. Assessment of Research project

A declaration by the candidate that the work was done by him/her shall be included. The guide, Head of the Department and Head of the Institution shall certify the bonafide of the project.

Total 200 marks shall be awarded for the research project and the marks distribution as follows:

- 100 marks – Dissertation evaluation by Internal and External examiners
- 100 marks – Continuous Internal Assessment

11.9. Evaluation of Dissertation

11.9.1. Dissertation shall be evaluated by two examiners, one external & one Internal for 100 marks from the panel of examiners approved by the Board of Studies and by the University.

11.9.2. The criteria for the evaluation shall be as prescribed by the Board of Studies.

11.9.3. Acceptance of the dissertation is a pre-requisite for a candidate to be eligible to appear in the final examination.

11.10. Guide:

11.9.l. The academic qualification and teaching experience required for recognition of guide shall be as given under:

11.9.2. DM in Nephrology with 2 years of teaching experience after MD/DM programme or Ph.D in Renal Dialysis or M.Sc. Renal Dialysis Technology with teaching experience of four years after the Masters programme.

11.9.3. Student guide ratio: A recognized guide shall supervise dissertation work of not more than five students per academic year. The age of the guide shall not exceed 65 years.

11.9.4. Co-Guide may be included provided the work requires substantial contribution from a sister department, another institution recognized for teaching in Yenepoya (Deemed to be University), or any other State level University.

11.11. Change of Guide:

In the event of registered guide leaving the Institute/ college due to any reason or in the event of death or any other valid reasons, guide can be changed with prior permission from the University only.

12.Eligibility to appear for University Examination

12.1.Each course (theory, practical, clinical etc.) shall be treated as an independent unit for the purpose of attendance. Candidates having minimum 80% attendance in each of the Courses can only qualify to appear for the Semester End Examination. The Candidates

with less than 80% of attendance shall be required to repeat that Course by attending the semester. There shall be no provision for condonation of shortage of attendance.

12.2. Evaluation of a course shall be done based on continuous internal assessment (CIA) mode followed by semester end university examination (SEE) for each course.

12.3. The components of CIA (Continuous Internal Assessment) may include sessional tests, Seminar/ Journal Club/ Case Studies /Assignment and other activities as determined by the board of studies in the respective departments.

12.4. The CIA:SEE percentage is 50:50 and minimum marks for CIA shall be 50% and SEE shall be 50%.

12.5. The pass marks per course shall be 50% There shall be examinations at the end of each semester ordinarily during February/March for odd semesters and August/September for even semesters

12.6. The SEE duration shall be two and half hours.

13. Criteria for passing

13.1. The CIA:SEE percentage is 50:50 and minimum marks for CIA shall be 50% and SEE shall be 50%.

13.2. The pass marks per course shall be 50%

13.3. A candidate shall be declared to have passed the PG program if he/she secures atleast CGPA of 5.0 (Course Alpha-Sign Grade P) in the aggregate of both internal assessment and semester end examination marks.

13.4. The candidates who pass all the semester examinations in the first attempts in Two years are eligible for ranks provided they secure at least a CGPA of 8.0 (atleast Alpha-Sign Grade A).

13.5. The results of the candidates who have passed the fourth semester examination but not passed the lower semester examinations shall be declared as NCL (Not Completed Lower semester examinations). Such candidates shall be eligible for the degree only after completion of all the lower semester examinations.

13.6. A candidate who passes the semester examinations in parts is eligible for only CGPA and Alpha-Sign Grade but not for ranking.

13.7. There shall be no minimum marks with respect to internal assessment and viva-voce marks.

13.8. A candidate who fails in any of the project work/project report/dissertation shall reappear for the same and pass the examination subsequently within the nearest semester and examination schedule.

14.Carry over provisions

Carry over shall be allowed to the candidates up to IV semesters.

15.Grading and Classification

The results of successful candidates at the end of each semester shall be declared in terms of Grade Point Average (GPA) and Alpha-Sign Grade. The results at the end of the sixth semester shall be classified on the basis of the Cumulative Grade Point Average (CGPA) obtained in all the four semesters and the corresponding overall alpha sign grade.

a. Letter Grades and Grade Points:

Letter Grade	Grade Point	Range of Marks
O+(Outstanding)	10	90–100
O(Excellent)	9	80–89.99
A+(Very Good)	8	70–79.99
A(Good)	7	60–69.99
B+(Average)	6	55–59.99
P(Pass)	5	50–54.99
F(Fail)	<5	<50

b. Cumulative Grade Point Average(CGPA):

The results at the end of the fourth semester shall be classified on the basis of CGPA obtained in the four semesters and the corresponding overall letter grade. The letter grade as described below shall be adopted.

Letter Grade	CGPA Range
O+(Outstanding)	9.0–10.0
O(Excellent)	8.0–8.99
A+(Very Good)	7.0–7.99
A(Good)	6.0–6.99
B+(Average)	5.5–5.99
P(Pass)	5.0–5.49
F(Fail)	<5.0

16. Re-Entry after Break of the study

16.1. Candidates admitted to a program abstaining for more than 3 months must seek readmission into the appropriate semester.

16.2. The candidate shall follow the syllabus in vogue (currently approved/is being followed) for the program.

16.3. All re-admissions of candidates are subject to the approval of the Yenepoya (Deemed to be University).

17. Journals

List of recommended Journals

a. The Nephron
b. Indian Journal of Nephrology
c. Indian Journal of Peritoneal Dialysis
d. Dialysis and Transplantation
e. Renal Sciences
f. International Journal of Nephrology
g. Hemodialysis International
h. Nephrology Dialysis and Transplantation
i. Therapeutic Apheresis and Dialysis
j. Peritoneal Dialysis International

Annexures:

Annexure I - Question Paper layout for theory examinations

Annexure II – Logbook template

Annexure III – Journal Club evaluation checklist

Annexure IV – Assignment guideline

Annexure V - Seminar Assessment Rubric Template

Annexure VI – OSPE/OSCE checklist