



MAHATMA GANDHI UNIVERSITY  
*of*  
MEDICAL SCIENCES & TECHNOLOGY  
JAIPUR

# Syllabus

**M.Sc. Dialysis Technology  
(2 Years Degree Course)**

## **Notice**

1. Amendments made by the University in Rules / Regulations of the Courses shall automatically apply.
2. The University reserves the right to make changes in the syllabus/books/ guidelines, fee structure or any other information at any time without prior notice. The decision of the University shall be binding on all.
3. The Jurisdiction of all court cases shall be Jaipur Bench of Hon'ble Rajasthan High Court only.

**M.Sc. Dialysis Technology (            )**  
(2 Years Degree Course + 1 Year Internship)

**Rules & Regulations**

**1. TITLE OF THE COURSE**

The title of the course shall be “M.Sc. Dialysis Technology”.

**2. DURATION OF COURSE/TRAINING**

The course shall be of two years duration and one year internship from the date of commencement of academic session.

**3. MEDIUM OF INSTRUCTION**

English shall be the medium of instruction

**4. ELIGIBILITY FOR ADMISSION:**

Candidate should have passed the Bachelor's Degree in Dialysis technology as one of the main subjects.

**5. CRITERIA FOR ADMISSION**

Selection shall be done by an Admission Board of the University strictly on merit. It will consist of two-step process –Written Entrance Examination followed by Counseling/Personal Interview (PI).

**6. RESERVATION POLICY**

Reservation shall be applicable as per policy of the State Government.

**7. ENROLMENT**

Every candidate who is admitted to M.Sc. Course in Mahatma Gandhi Medical College Medical Sciences & Technology after paying the prescribed eligibility and enrolment fees.

A candidate shall deposit enrolment fees along with tuition fees at the time of his/her admission to the course. Such a candidate who fails to submit, through the college Principal, duly filled enrolment form along with original documents including migration certificate required for enrolment within two months of his/her admission or up to November 30 of the year of admission whichever is later, he/she will have to pay late fee prescribed by the University

**8. MIGRATION RULES**

No student, once admitted to the course and enrolled by the University, will be permitted to migrate to any other Course/ University. No student will be admitted to the Course on migration from any other Course/ University.

## 9. ATTENDANCE

Minimum 75% attendance in each year, both for theory and practical classes separately. Student with deficient attendance will not be permitted to appear in University examination.

## 10. TRAINING:

- 1) The period of training for M.Sc. shall be of two years from the date of admission.
- 2) Part – I and Part – II of the course shall be of one-year duration each.
- 3) The candidate will undertake the post graduate training as a full time post graduate in the department concerned.
- 4) The students will be required to complete the prescribed period of study and fulfill the requirement of attendance before they are allowed to appear in the University examination.

## 11. EXAMINATION AND ASSESSMENT

1. The examination of Part I shall consists of three theory papers and internal assessment and practical & viva-voce examination.
2. The examination of Part II shall consist of three theory papers & internal assessment and practical in the opted specialization.
3. A candidate shall be permitted a maximum of 4 years from the year of admission to complete the course and pass the examination failing which, the candidate will have to leave the course.
4. Only those candidates will be allowed to appear at Part II examination, who have passed Part –I examination completely.
5. Degree of M.Sc. Dialysis technology will be awarded to a candidate only after his successful completion of one year compulsory internship.

## 12. CONDUCTION OF THE UNIVERSITY EXAMINATION:

University examination shall be conducted twice in a year; that is Main and Supplementary Examination. Supplementary examination shall be conducted after 2-4 months of the main examination.

## 13. SCHEME OF EXAMINATION

**The Examination in Part I shall consist of:**

<b>Paper</b>	<b>Marks</b>
<b>Theory</b>	
Paper I - Basic Sciences and clinical Nephrology	100 Marks
Paper II -Basic principles and overview of types of renal replacement therapy (HD & PD)	100 Marks
Paper III-Epidemiology & biostatistics	100 MARKS
<b>Internal Assessment</b>	100 Marks
<b>Practical &amp; Viva Voce Examination</b>	100 Marks
<b>Total Marks</b>	<b>500 Marks</b>

**Notes:**

- Each theory paper shall be of 3 hours duration.
- Each paper will be set by the External Examiner of the subject concerned and will be assessed by the internal examiner of the subject concerned.

Pattern of questions to be set and answered shall be as follows:

<b>Paper</b>	<b>No. of questions to be set</b>	<b>No. of questions to be answered</b>
Paper I	4	4
Paper II	4	4
Paper III	4	4

- In order to pass the University Examination, the candidate must secure a minimum of 50% marks in each theory paper including internal assessment and 50% marks in practical and viva-voce examination separately.
- A candidate who has failed in one or more theory paper of Part-I Examination must appear in that theory paper in supplementary examination which will be conducted by university within 2 – 4 months.

**The Examination in of Part II shall consist of:**

<b>Paper</b>	<b>Marks</b>
<b>Theory</b>	
Paper I - Recent advance HD Procedures & complications in renal disease patients Dialysis patients & Renal Nutrition	100 Marks
Paper II -Management of Dialysis Unit & Biomedical InstrumentationBiotechnology & Molecular Biology	100 Marks
Paper III -Emergency Medicine / ACL Nephro– Radiological, Nuclear Medicine and imaging sciences Nephropsychiatry	100 Marks
<b>Internal Assessment</b>	100 Marks
<b>Practical &amp; Viva Voce Examination</b>	100 Marks
<b>Total Marks</b>	500 Marks

**Notes:**

1. Each theory paper shall be of 3 hours duration.
2. All papers shall be set by the External Examiners.
3. Paper I will be assessed by the External Examiner and Paper II will be assessed by the Internal Examiner viz. Head of the Department of subject concerned. Paper III will be assessed by Professor / Associate professor / Assistant professor

Pattern of questions to be set and answered shall be as follows:

<b>Paper</b>	<b>No. of questions to be set</b>	<b>No. of questions to be answered</b>
Paper I	4	4
Paper II	4	4
Paper III	4	4

4. Practical examination shall be conducted by one Internal, one External Examiner which will be appointed by the university.
5. In order to pass the examination the candidate must secure a minimum of 50% marks in Theory papers including internal assessment and 50% marks in practical and viva-voce examination separately.
6. In case a student passes either in Theory or in Practical only, the student shall be considered to fail in the whole examination and he will have to appear in both the Theory and Practical in the subsequent examination.

#### **APPOINTMENT OF EXAMINER AND PAPER SETTERS**

- 1) All the examiners, paper setters, theory examination answer books evaluators, Internal and External Examiners for Practical examinations shall be appointed by the President of the University.
- 2) Qualification of the Paper setter / Examiner: Assistant Professor and above.
- 3) Paper setter can be an examiner

#### **14. GRACE MARKS**

No grace marks will be provided in M.Sc. Examination

#### **15. REVALUATION / SCRUTINY**

No Revaluation of answer books shall be permitted in M.Sc. Examination. However, the candidate can apply for scrutiny of marks as per University Rules.

**Curriculum Outline**  
**Distribution of Teaching hours**

**FIRST YEAR – THEORY**

<b>Main subject Theory</b>	<b>Total No. of Hours</b>
1. Basic Sciences in Nephrology *	200
2. Clinical Nephrology	100
3. Basic principles and overview of types of renal replacement therapies (HD & PD)	130
4. Epidemiology & Biostatistics	60
<b>5. Subsidiary subject: Medical Ethics</b>	<b>10</b>
<b>Total:</b>	<b>500</b>

**PRACTICALS**

<b>Area of posting / Subject</b>	<b>Total No. of hours</b>
1. Dialysis Room	430
2. Water treatment plant	50
3. Electronics, Plumbing , Computer	70
4. Management of Dialysis unit	50
5. ICU Side Dialysis	20
6. Peritoneal Dialysis	20
7. Special & advanced dialysis procedures	20
8. CPR Demo	10
9. Teaching Methodology	100
10. Groups Discussion	30
<b>Total :</b>	<b>800</b>

## **SECOND YEAR – THEORY**

<b>Branches Theory</b>	<b>Total No. of Hours</b>
1. Recent advances in HD Procedures & complications in renal disease patients, Dialysis patients & Renal Nutrition	220
2. Management of Dialysis Unit & Biomedical Instrumentation , Biotechnology & Molecular Biology	140
3. Emergency Medicine, ACL, Nephro – Radiological and imaging sciences, Nuclear Medicine and Nephropsychiatry	60
<b>Total</b>	<b>400</b>

## **PRACTICALS**

<b>Area of posting / Subject</b>	<b>Total No. of Hours</b>
1. Dialysis Room	400
2. Water treatment plant	20
3. Electronics, Plumbing , Computer	20
4. Management of Dialysis unit	100
5. ICU Side Dialysis	50
6. Peritoneal Dialysis	10
7. Special & advanced dialysis procedures	200
8. Teaching Methodology	300
9. Groups Discussion	20
10. Machine Management	180
<b>Total :</b>	<b>1300</b>



# **SYLLABUS**

## **M.Sc. Dialysis Technology (                    )**

(2 Years Degree Course + 1 Year Internship)

### **Learning Objectives:**

- 1) At the completion of this course, the student should be –
- 2) The provision of a sound foundation in the broad aspects of dialysis technology.
- 3) The encouragement of the progressive assumption of responsibility by the student for the needs of the patient to ensure a caring, patientcentred approach.
- 4) The development of the ability of the student to transfer his knowledge and understanding to new situations.
- 5) The provision of a course which enables practitioners to proceed to advanced study thus providing for the future development of teachers, clinical supervisors, research workers and managers, with a progressive career structure.

### **Assessment:**

The examination to the first/second year shall be open to a student who: has remained on the rolls of the course concerned for full on academic year preceding the examination and having attended not less than 75% of the full course of lectures and 75% practical separately held for the purpose in each year.

## **FIRST YEAR**

### **Course content (Syllabus) Theory**

#### **Paper I: Basic Sciences in Nephrology and Clinical Nephrology**

- I. Anatomy of Urinary Tract & Kidney (30hrs)**
- 1. Gross anatomy of the kidney (6hrs)**
- Location of kidney
  - Size
  - Protection
  - Structure of the kidney – gross structure blood supply, nerve supply, lymphatic flow, L.S of Kidney.
- 2. Basic anatomy of urinary system (8hrs)**
- The Kidney (structural anatomy)
  - The ureter
  - The bladder
  - The urethra
  - Sphincters
  - Prostate
- 3. Microscopic anatomy (4hrs)**
- Nephron: Glomerular structure, tubules
  - Interstitium
  - Juxta Glomerular apparatus
- 4. Embryology and fetal development in brief (2hrs)**
- 5. Anatomy of peritoneum (4hrs)**
- Description
  - Size
  - Nature
  - Blood supply
  - Lymphatic drainage
- 6. Anatomy of Vascular system related to Hemodialysis. (6hrs)**
- Upper limb vessels.  
(Course, distribution, branches, origin, and abnormalities)
  - Neck vessels.  
(Course, distribution, branches, origin, and abnormalities)

- Femoral vessels.  
(Course, distribution, branches, origin, and abnormalities)

## **II. Physiology of Kidney: (30hrs)**

### **1. Basic concepts (6hrs)**

- renal auto regulation of blood supply & GFR
- clearance
- Tubular reabsorption
- Aldosterone, ADH & water homeostasis
- Tubular secretion
- Maximal tubular transport capacity

### **2. Summary of major functions of Nephron & its components in urine formation. (4hrs)**

- Glomerulus
- PCT
- Henley's loop (Descending limb & thick ascending limb)
- DCT
- Collecting duct: Cortical, Medullary.

### **3. Renal regulatory Mechanism (4hrs)**

- Water regulatory mechanism
- Electrolyte regulation (Sodium, Potassium, Chloride, Calcium, Phosphate, Magnesium)
- Regulation of acid – base balance (basic principles & abnormalities)

### **4. Renal hormones & vit D, erythropoietin, Renin, Prostaglandins (2hrs)**

### **5. Physiological values (2hrs)**

- Urea, Creatinine, Electrolytes, Calcium, Phosphorus, uric acid, Magnesium, Glucose.
- 24 hours urinary indices – urea, Creatinine, electrolytes Ca, M

### **6. Physiology of peritoneum during P.D (2hrs)**

Diffusion through the peritoneum.

- Definition
- Factors influencing solute transport
  - a) Peritoneal permeability
  - b) Solute characteristics
  - c) Concentration gradient
  - d) Peritoneal blood flow
  - e) Dialysis solution temperature

f) Available membrane area

**7. Routes of solute transport. (1hrs)**

- Intracellular.
- Extracellular.

**8. Factors that enhance diffusion. (1hrs)**

- Increased dialysis solution flow.
- Increased blood flow.
- High concentration gradient.
- Pre-warmed dialysis solution.
- Osmotic pressure.

**9. Osmosis through the peritoneal membrane. (2hrs)**

- Ultrafiltration.
- Drug transport.

**10. Composition and function of blood – Introduction (4hrs)**

- Red blood cells: Erythropoiesis, stages of differentiation, function, count, physiological variation.
- Hemoglobin: structure, functions, concentration, physiological variation, methods of estimation of Hb
- White blood cells: Production, function, life span, count, differential count
- Platelets: Origin, normal count, morphology, functions.
- Plasma Proteins – Production, concentration, types, albumin, globulin, Fibrinogen, prothrombin, functions.
- Hemostasis & Blood coagulation: Hemostasis: Definition, normal hemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.
- Blood Bank : Blood groups –
  - ABO system, Rh system
  - Blood grouping & typing
  - Cross matching: Rh system – Rh factor, Rh incompatibility.
- Blood transfusion – Indication, universal donor and recipient concept.
- Selection criteria of a blood donor. Transfusion reactions Anticoagulants – Classification, examples and uses
- Anemia's: Classification – morphological and etiological. Effects of anemia on body

- Erythrocyte sedimentation Rate (ESR) and Packed cell volume
- Blood Volume: Normal value, determination of blood volume and regulation of blood
- Volume
- Body fluid: pH, normal value, regulation and variation
- Lymph: lymphoid tissue formation, circulation, composition and function of lymph

**11. Hemostasis –basic principles (2hrs)**

- Coagulation cascade
- Coagulation factors
- Regulation of procoagulants & anticoagulants BT, CT, PT, PTT, thrombin time

**III. Biochemistry (30hrs)**

1. Biological oxidation oxidative reduction electron transport chain-bioenergetics system-high energy phosphates system.
2. Metabolism of carbohydrates- aerobic & anaerobic metabolic metabolism of glucose-Role of liver in carbohydrate metabolism-alternate aerobic pathway-Role of carbohydrate metabolism-Alternate aerobic pathway-pentose-muscle contraction-regulation of blood sugar-metabolism of other hexoses.
3. Lipid metabolism-Introduction-Blood lipids-absorption-oxidation of fatty acids-synthesis- energetic of fat metabolism-metabolism of cholesterol.
4. Protein metabolism-Absorption-storage-general pathway-nitrogen metabolism-anabolism- catabolism-Metabolism of amino acids
5. Water & Mineral Metabolism-Sodium – potassium- chloride-Sulphur-calcium-phosphorus- magnesium-Ion Iodine copper-Zinc etc.
6. Classification, mechanism of action of hormones regulating hormones calcium and phosphorous.
7. Regulation of pH of Blood and body fluids: Regulatory mechanisms, Renal Mechanism, Disturbances in acid-base balance, respiratory acidosis , respiratory alkalosis, metabolic acidosis, metabolic alkalosis, assessment of the acid- base balance, carbon-di-oxide combining power of blood,alkali reserve, anion gap, Evaluation of Acid –Base balance
8. Renal function Formation and composition of urine – Specific gravity and pH, solids and
9. 24 hour urine, abnormal constituents of urine- Glycosuria - glycosuria, fructosuria, pentosuria, lactosuria, galactosuria. Proteinuria, Ketone bodies, Bile pigments and bile salts, Blood, porphyrins, Urinary lithiasis.
10. Function & Test of Liver.
11. Over view of estimation of serum creatinine, blood urea, serum electrolytes, 24 hrs.

Urinary protein – Labmethods.

**IV. Nephropathology:**

**(30hrs)**

1. Renalhistology.
2. Renalpathology
  - Glomerular diseases
  - Tubulo interstitial nephritis
  - Chronic renal failure
3. Allograft pathology
4. Hypertension and other vascular diseases
5. Hemogram
6. Peripheral blood smear

7. Urine analysis

- Urine collection
- Physical characteristics (Color, smell)
- Specific gravity and osmolality
- pH
- Glucose
- Ketones
- Electrolytes
- Protein & related substances
- Sediments – cells, crystals, casts

**V. Nephro-immunology**

**(20hrs)**

Nature of the Immune system

1. Historical concepts and introduction to serological testing:
  - a. Immunity and immunization
    - Cellular versus humoral immunity
    - Antigens and haptens
    - Cells – mediated immunity
  - b. The Age of serology
  - c. Other historical developments
2. Natural Immunity:
  - a. External defense system

- b. Internal defense system
  - cellular Defense mechanism
  - acute phase reactants
  - inflammation
- c. Summary
- 3. The lymphoid system:
  - a. Primary lymphoid organs
    - Bone marrow
    - Bursa of Fabricius
    - Thymus
  - b. Secondary lymphoid organ
    - Spleen
    - Lymph nodes
    - Other secondary organs
- c. Surface marker on lymphocytes
- d. Stages in B-cell differentiation
  - Pro- B cells
  - Pre – B cells
  - Immature B cells
  - Mature B cells
  - Activated B cells
  - Plasmacells
- e. T cells Differentiation
  - Double – negative stage
  - Double positive stage
  - Mature T cells
  - Antigen activation
- f. Third population or natural killer
  - Mechanism of cytotoxicity
  - Antibody – Dependent cell
- g. Laboratory identification of lymphocytes
  - Fluorescence Microscopy
  - Cell flow cytometry
  - Other methods

- h. Summary
4. Nature of Antigens and the MHC Complex
    - a. Factors influencing the immuneresponse
    - b. Traits of Immunogens
    - c. Nature of epitopes
    - d. Haptens
    - e. Relationship of antigens to the Host
    - f. Adjuvants
    - g. Major Histocompatibility Complex
      - Genes coding for the HLA antigens
      - Class I antigens
      - Class II antigens
      - Antigen presentation
      - MHC and Autoimmunity
  5. Antibody structure and Function:
    - a. Tetra peptide structure of immunoglobulin
      - Cleavage with papain
      - Pepsin digestion
    - b. The Nature of Light Chains
    - c. Heavy chain sequencing
    - d. Antigen recognition unit
    - e. Hinge region
    - f. IgG
    - g. IgM
    - h. IgA
    - i. IgD
    - j. IgE
    - k. Theories of antibody diversity
      - l. Genes coding for immunoglobulin
      - m. Monoclonal antibody
      - n. Summary
  6. Cell-Mediated Immunity:
    - a. Activation of T Helper cells
      - Adhesion molecules
      - Specific Antigen recognition



- Function of Interleukin-2
  - Triggering of Interleukin-1
  - T- Helper subsets
- b. Stimulation of B cells
  - c. Activation of cytotoxic T cells
    - Role of cytokines in the inflammatory response
    - I-1, I-2, I-3, I-4, I-5, I-6, Other I, Interferon's, TNF, other factors
  - d. Laboratory determination of T lymphocyte function
    - Summary
7. Complement:
- a. The classic pathway
    - The recognition unit
    - The activation unit
    - The membrane attack
  - b. The alternative pathway
  - c. System controls
    - fluid phase regulators
    - cell – bound regulators
  - d. Other cell membrane receptors
  - e. Biologic manifestation of complement activation
- f. Complement and Disease states
  - g. Complement deficiencies
    - Paroxysmal Nocturnal Hemoglobinuria
    - Other complement
      - Laboratory detection of complement abnormalities
      - summary
8. Transplantation:
- a. Review of MHC
  - b. Transplantation
    - Descriptive terms
    - Graft rejection
    - Tissue matching
    - Types of tissues and organ transplanted
    - Prevention and treatment of rejections

<b>VI. Microbiology Related To Dialysis</b>	<b>(40hrs)</b>
<b>1. Morphology</b>	<b>2hours</b>
Classification of microorganisms, size, shape and structure of bacteria	
<b>2. Bacterial growth and nutrition</b>	<b>2hours</b>
Nutrition, growth and multiplications of bacteria	
<b>3. Sterilisation and Disinfection</b>	<b>2hours</b>
Principles and use of equipments of sterilization	
<b>4. Immunology</b>	<b>2hours</b>
Immunity, Vaccines and immunization	
<b>5. Systematic Bacteriology</b>	<b>15 hours</b>
Morphology, cultivation, diseases caused and laboratory diagnosis ( Staphylococci, Streptococci, Pneumococci, Gonococci, Meningococci, <i>C. diphtheriae</i> , Mycobacteria, Clostridia, Bacillus, Shigella, Salmonella, <i>E. coli</i> , Klebsiella, Proteus, <i>vibrio cholerae</i> , Pseudomonas & Spirochetes)	
<b>6. Parasitology</b>	<b>5hours</b>
Morphology, life cycle, laboratory diagnosis of following parasites <i>E.histolytica</i> , Plasmodium, Tape worms, Intestinal nematodes	
<b>7. Mycology</b>	<b>3hours</b>
Morphology, diseases caused and lab diagnosis of Candida, Cryptococcus and opportunistic fungi	
<b>8. Virology</b>	<b>4hours</b>
General properties of viruses, diseases caused lab diagnosis and prevention of Hepatitis and HIV viruses	
<b>9. Hospital infection</b>	<b>3hours</b>
Causative agents, transmission methods, investigation, prevention and control	
<b>10. Biomedical waste management</b>	<b>2hours</b>
<b>VII. Pharmacology</b>	<b>(20hrs)</b>
<b>1.</b>	<b>Medications commonly</b>
used by patient with renal failure	<b>(8hrs)</b>
• Antacids and phosphate binders	
• Anti anemic drugs	
• Anticoagulants	

- Antihypertensives
- Antimicrobials
- Antipruritis
- Cardiovascular drugs
- Chelating agents
- Electrolytes
- Laxatives and
- Local anesthetics
- Potassium ion exchanger resin
- Thrombolytic agents
- Vitamins

**2. Pharmacology related to Renal disease, Hemodialysis and Peritoneal dialysis (12hrs)**

- Pharmacokinetic and Pharmacodynamic principles
- IV fluid therapy with special emphasis in renal disease.
- Diuretics—Classification, actions, dosage, side effects & contraindications
- Antihypertensive—Classification, action, dosage, side effects & contraindications, special reference during dialysis, vasopressors
- Drugs used in hypotension.
- Drugs & Dialysis—Dose & duration of administration of drugs
- Dialysable drugs—Phenobarbitone, Lithium, Methanol etc
- Vit D & its analogues, phosphate binders, iron, folic acid & other vitamins of therapeutic value
- Erythropoietin in detail.
- Heparin including low molecular weight heparin
- Protamine sulphate.
- Glutaraldehyde, sodium hypochlorite, hydrogen peroxide role as disinfectants & adverse effects of residual particles applicable to glutaraldehyde
- Haemodialysis concentrates – composition & dilution (Acetate & bicarbonates)
- PD fluid in particular hypertonic solutions composition (Dextrose, icodextrin solutions)
- Potassium exchange resins with special emphasis on mode of administration.

**Clinical Nephrology (100 hrs)**

**I. Kidney disease (60 hrs)**

Basic concepts related to renal failure (2 hrs)

Classification of renal disease – Acute Kidney Injury, Chronic Kidney Disease (2 hrs)

(Diagnosis, Precaution, Management)

**A. Acute Kidney Injury (10hrs)**

Classification

- Pre renal uremia (Etiology, pathophysiology, assessment, management)
- Intra-renal uremia (Etiology, pathophysiology, assessment, management)
- Post renal uremia (Etiology, pathophysiology, assessment, management) Clinical course
  - AKI
- Initiating stage
- Oliguric stage
- Diuretic stage
- Recovery stage

**B. Chronic Kidney Disease**

**(26hrs)**

1. (Includes causes, signs and symptoms, treatment)

- Developmental/congenital disorder
- Cystic disorder
- Tubular disorder
- Neoplasms
- Infectious disease
- Glomerulonephritis
- Obstructive disorders

2. Renal problem and systemic disease

- Diabetes mellitus (DM)
- Diabetes insipidus (DI)
- Primary hyperparathyroidism
- Hepatorenal syndrome
- Gout
- Amyloidosis
- Scleroderma or progressive systemic sclerosis
- Goodpasture syndrome
- SLE (Systemic lupus erythematosus)
- HUS
- Nephrotic syndrome
- Hypertensive nephropathy

**C. Renal problem in pregnancy**

**D. Stages of renal dysfunction**

**(2hrs)**

Stages	Creatinine clearance (ml/min/1.73m <sup>2</sup> )	Metabolic consequences
I. Stage Normal	>90	---

II. Stage Early Renal insufficiency	60-89	Increased serum PTH
III. C.K.D	30-59	Increased calcium absorption Anemia
IV. Pre-end stage failure	15-29	Increased TD, PO <sub>4</sub> , K <sup>+</sup> acidosis
V. ESRD	<15	Uremic

E. Complications of chronic renal failure

- Anemia
- Polyneuritis
- Pericarditis
- Renalosteodystrophy
- Uremic carbohydrate intolerance
- Gynecomastia
- Infection
- Pruritus

**Approach to Patient with Renal Failure**

**(10hrs)**

F. Manifestations of renal failure:

- Systemic consequence of renal failure Alterations in following including signs, symptoms etiology & management.
- Uremia
- Fluid balance
- Electrolyte and ion balance (sodium, potassium, calcium, phosphate, Magnesium, hydrogen, bicarbonate, aluminium)
- Acid – base balance (Metabolic acidosis)
- Cardiovascular system (Hyperkalemia, Hypertension, Pericarditis, Pericardial effusion, Pericardial tamponade)
- Respiratory system
- Gastrointestinal system
- Hematological system (Anemia, Platelet dysfunction)
- Endocrine function
- Neuromuscular function & sleep problems
- Skeletal system
- Psycho-social function
- Dermatological manifestations

G. Patient history

H. Physical assessment of the renal system

I. Blood analysis

- Plasma Creatinine
- Blood urea nitrogen
- Plasma electrolytes
- Erythropoietin
- Plasma Renin
- Plasma substances (Antibodies & component with immunologic renal disorders like C3 / C4 ANA)

#### J. Clearance tests

- Creatinine clearance test, urea clearance.

#### K. Treatment

(5hrs)

3 basic stages

- Pressure reduction in remaining nephrons
- Conservative treatment of uremic syndrome
- Dialysis and transplantation Indications of dialysis in AKI Indications of dialysis in CKD

#### L. Contraindications for Dialysis (Including PD)

(3hrs)

- Alzheimer's Disease
- Multi-infarct denaturation
- Hepatorenal syndrome
- Advanced cirrhosis with encephalopathy
- Advanced malignancy etc

## II. Renal transplantation

(40hrs)

### 1. History and statistics

- Historical events
- Statistics
- Data sources of renal replacement therapies

### 2. Immunological aspects

- Functions of the immune system
- Innate system
- Acquired (lymphoid) immune system
- Major histocompatibility complex

### 3. Evaluation of Potential Kidney transplant recipient & Donor

### 4. Storage & transplant of Kidneys

### 5. Pre/ Peri/ Post-operative issues

### 6. Complications of renal transplant

### 7. Long term concerns

8. Commonly prescribed medications
9. Diagnosis of acute rejection
10. Other causes of sudden loss of renal function
11. The case with good initial renal function
12. The case with poor initial function
13. Uncontrollable rejection
14. Transplants in diabetes
15. Long term followup
16. Late complications
17. Long term prognosis

**Paper II:**

**Basic Principles and overview of Types of Renal Replacement Therapy (HD&PD) (130hrs)**

**I. Renal Replacement Therapy (30hrs)**

**1. Indications (10hrs)**

Most common cited clinical indications are

- Fluidoverload
- Severehypertension
- Hyperkalemia
- Metabolicacidosis
- Uremia

**2. Indications forstarting dialysis (10hrs)**

- Oliguria (urine output <200ml/12hr)
- Anurial/extremeoliguria
- Hyperkalemia ([K]>6.5mEq/l)
- Severe acidemia(pH<7.1)
- Azotemia ([urea] >30mg/dl)
- Clinically significant organ (especially pulmonary)edema
- Uremicencephalopathy
- Uremicpericarditis
- Uremicneuropathy/myopathy
- Severe dysnatremia ([Na] <115 or > 160meg/L)
- Hyperthermia
- Drug overdose with dialyzabletoxin

**3. Management of renal failure patients: (10hrs)**

- Nutritional management in Renal failure (CKD, HD, CAPD, TRANSPLANT) (protein, calories, malnutrition).
- Anemia management in renalfailure
- Medication for renalfailure
- Investigation for renalfailure
- Renal failure in children and pregnancy and itsmanagement

**II. Concepts and principles of HD & PD and its application to patient care.( 100hrs)**

**A. History & TypesofDialysis (2hrs)**

- Hemodialysis



- Peritonealdialysis
- Hemofiltration

**Principles of Dialysis** (2hrs)

- Reviewed basic knowledge

**Basic Concepts Related To Dialysis** (6hrs)

**1. Basic chemistry concepts** (3hrs)

a. Review

- an atom & atomic weight
- Molecules & molecular weight
- Mole
- Ions
- Density
- Connection
- Adsorption

b. Dialyser categories

- Convective dialyser
- High efficiency dialyser
- High Flux dialyser

c. Dialyser types depending on their design and their comparative studies. (Hollow fibre, coiled, parallel plate)

d. Measuring Dialyser efficiency

- Determining Dialyser clearance  $CB_i - C_{B_o}$   
 $k_{\dots\dots\dots} \times Q_b C_{B_i}$
- Determining UF rate ---  $K_{uf}$

**B. Dialysate Purpose**

Composition of dialysate

Sodium, Potassium, Magnesium, calcium, chloride, Glucose, Bicarbonate, Acetate Dialysate delivery system.

- Proportioning system
- Monitoring system

Conductivity, Temperature, flow rate, Dialysate pressure, TMP blood leak detection, pH.

## 1. Water treatment Plant

(6hrs)

### A. Purpose

- Preventing harm to Pt
- Preventing harm to equipments

### B. How water become impure?

### C. Types of contaminants and effects on Pts

- Micro –organisms
- Solid impurities
- Chemical impurities

### D. Components of water treatment plant & their arrangement (Feed water components, R.O process)

### E. Monitoring water treatment plant

- Continuous
- Periodic monitoring
- Microbiological testing
- Chemical monitoring (Chloramines, Na<sup>+</sup>, K<sup>+</sup>)
- Patient monitoring  
(Routine blood chemistries, Monitoring Pt. Symptoms)

### F. Disinfection.

## 2. Dialysis Machine (5hrs)

- Types
- Function Dialysate circuit
- Blood circuit Delivery and monitoring
- Delivery and monitoring Alarm function
- Equipment Dysfunction
- Maintenance & repair

## 3. Vascular access

(15hrs)

- Historic forms of vascular access External A.V shunt  
Single needle devices Button devices
- Development of vascular access surgery
- Patient assessment and planning for vascular access surgery
- Anaesthesia for surgery of vascular access
- Surgical anatomy for HD access

## Physiology of types of vascular access and clinical consideration

- Physiology of Arteriovenous fistula, Arteriovenous graft, Tunnelled Hemodialysis catheters
- Temporary type (IJC, S.C,F.C)
- Semipermanent
- PermanentType
  - a) Types of catheter
  - b) Choice ofdevice
  - c) Catheterplacement
  - d) Placementtechniques
  - e) Cut downtechniques
- External jugularvein
- Internal jugularvein
- Femoralvein

## f) Placement under radiographicguidance

- UltrasoundComplications
- Infectiouscomplications
- Mechanicalcomplications
- Thromboticcomplications

## **Acute complications of central venous catheter**

### Thoracic

- Pneumothoracic
- Tension thoracic
- Subcutaneous

### Emphysema Hemothorax

- Hemomediastinum
- Hydromediastinum
- Tracheal

### Perforation Arterial

- Subcutaneoushematoma
- Arteriallaceration
- Arteriovenousfistula
- Pseudo

### Aneurysm Venous

- Venouslaceration
- Airembolism
- Catheter

## Embolism Lymphatic

- Thoracic duct laceration Cardiac
- Right ventricular interaction
- Arrhythmia
- Perforation and tamponade Neurologic
- Brachial plexus
- Stellate ganglion
- Phrenic nerve
- Vagus nerve
- Recurrent laryngeal nerve Catheter misplacement

## Late complications

- Catheter obstruction Thoracic
- Hydrothorax
- Hydro mediastinum Venous
- Air embolism
- Central vein thrombosis
- Superior vena cava syndrome
- Hepatic vein thrombosis Cardiac
- Arrhythmia
- Perforation and tamponade
- Coronary sinus thrombosis Lymphatic
- Lymphatic fistula
- Chylothorax Septic
- Catheter sepsis
- Septic thrombosis
- Suppurative thrombophlebitis
- Catheter performance and care
- Expected performances
- Complication, Prevention, Treatment
- Assessment and intervention for A.V.F maturation
- Non surgical methods for salvaging failed dialysis access
- Revisional surgery for failed access
- Nursing care for patient with dialysis access.
- New synthetic grafts and early access
- Biological properties of venous access devices.
- Complication of vascular access
- Infection in vascular access procedures
- Access in the neonatal and pediatric patients
- Improving vascular access outcomes

Continuous quality improvement (CQI) Clinical practice guidelines

#### **4. Dialysis prescription**

**(5hrs)**

Duration, Dialysate, UF, Heparin, Investigation, Medication usually given during HD in the following cases,

- For acute renal failures
- For chronic renal failure
- First HD
- Regular HD
- HD & Surgery
- HD for transplant recipients
- HD for poisoning case
- Phlebotomy

#### **5. Anticoagulation**

**(7hrs)**

a. Purpose

b. Anticoagulant requirement depending on

- Patient Characteristics
- Medical characteristics (Fever, infection, uremic etc)
- Dialyzer system characteristics
- Drug characteristics

c. Administration of Heparin during dialysis

d. Methodology

- Continuous
- Intermittent (Periodic)
- low dose (tight)
- Systemic
- Regional
- Baseline
- Controlled

e. Anticoagulation tests

- Whole blood clotting time
- Whole blood activated clotting time
- Whole blood partial thromboplastin time

f. Principles of anticoagulation

g. Heparinisation based on Pt's wt

h. Complications of Heparin therapy

i. Inadequate heparinisation

j. Heparin free dialysis

k. Other anticoagulants

l. Regional citrate anticoagulation

- Advantage
- Disadvantage

**6. Adequacy of Dialysis**

**(10hrs)**

- Urea reduction ratio (URR)
- Urea kinetic Modelling (UKM)
- $Kt/v$

Factors affecting dialysis treatment

- Clearance factor
- Time factor
- Blood flow
- Dialysate flow & type
- Dialysis
- Vascular access
- Patient Dialyser (reprocessing)
- History
- Purpose
- Safety
- Advantage
- Disadvantage
- Steps
- Methods of reprocess
- Disinfectants
- Fiber bundle volume
- Fiber integrity test

Concepts & Principles of Peritoneal Dialysis

**(20hrs)**

A. PD Apparatus

- PD Catheter access
- Solution

B. Pt.selection

C. P.DProcess

D. Modalities

E. Prescription

F. Type ofPD

G. Adequacy ofPD

Dialysis in Special Situations

**(12hrs)**

- Pt's with congestive cardiacfailure
- Advanced liverdisease
- Pts positive for HIV, HCV,HBSAg
- Failedtransplant
- Poisoningcases
- Pregnancy
- Dialysis infants & children and care of pediatricpatients.
- ICU cases and patientcare.

Special Dialysis Procedure

**(5hrs)**

- Continuous Therapies inHD
- Haemodiafiltration
- Haemoperfusion
- SLED
- MARS
- Plasmapheresis

**(3hrs)**

**Paper III: Epidemiology & Biostatistics  
hours)**

**(60**

**Unit 1: Introduction:**

Introduction to bio statistics and research methodology, types of variables and scales of measurements, measures of central tendency and dispersion, Skewness and Kurtosis rate, ratio, proportion, Incidence and prevalence.

**(4hrs)**

**Unit 2: Sampling:**

Random and non-random sampling, various methods of sampling —simple random, stratified, systematic, cluster and multistage. Sampling and non-sampling errors and methods of minimizing these errors.

**(4hrs)**

**Unit 3: Basic probability distributions and sampling distributions:**

Concept of probability and probability distribution. Normal, Poisson and Binomial distributions, parameters and application. Concept of sampling distributions. Standard error and confidence intervals.

**(6hrs)**

**Unit 4: Tests of significance:**

- Basics of testing of hypothesis — Null and alternate hypothesis, type I and type II errors, level of significance and power of the test, p value.
- Tests of significance (parametric)- t — test (paired and unpaired), Chi square test and 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.

**(10hrs)**

**Unit 5: Correlation and regression:**

Simple correlation — Pearson's and Spearman's; testing the significance of correlation coefficient linear and multiple regression.

**(4hrs)**

**Unit 6: Sample size determination:**

General concept, sample size for estimating mean and proportion, testing of difference in means and proportions of two groups

**(4hrs)**

**Unit 7: Study designs:**

- Descriptive epidemiological methods — case series analysis and prevalence studies.
- Analytical epidemiological methods — case control and cohort studies.
- Clinical trials/intervention studies, Odds ratio and relative risk, stratified analysis.

**(10hrs)**



**Unit 8: Multivariate analysis:**

Concept of multivariate analysis, introduction to logistic regression and survival Analysis **(6hrs)**

**Unit 9: Reliability and validity evaluation of diagnostic tests. (4hrs)**

Cronbach's alpha and test – retest methods

**Unit 10: Format of scientific documents.**

Structure of research protocol, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta-analysis. **(8hrs)**

## **SECOND YEAR - THEORY**

Paper VI: Basics of Hospital Administration and Management of Dialysis Unit & Biomedical I Instrumentation Biotechnology & Molecular Biology (140hrs)

### **1. Patient education & health patient withrrt**

**(30hrs)**

- Patient Education
- Communication
- Patient communication problems
- Explanation of examinations
- Interacting with terminally ill patient
- Informed Consent
- Patient counselling on
  - Living with CKD
  - Life with HD and CAPD
  - Living with a transplanted kidney.

### **2. Basics of Management of health care organization include administrative aspects of dialysis unit**

#### **A. Hospital Structure**

**(10hrs)**

Basics of

- Intensive care units
- Hospital administration
- Resource management (personnel, material & finance)
- Quality management & infection control systems

#### **B. Management of Healthcare Organizations**

**(40hrs)**

#### **C. Management functions**

- Planning
- MBO
- Decision making
- Organizing
- Staffing
- Controlling Management and Economics
- Demand & Supply
- Nature of Costs
- Marginal cost and breakeven analysis

- Market structure: Business & Government
- Role of Government Organizational Behavior
- Significance
- Structure & theories
- Individual & group behavior
- Leadership
- Motivation
- Organizational development
- Managing creativity and stress Accounting for Hospital Management
- Budgeting & Budgetary control
- Difference between forecast & budgeting\_ Preparation of budget Classification of budget
- Capital Budgeting Concept of Hospital
- Departmentation in Hospital
- Clinical services management
- Organizing of support services
- Management of utility services
- Evaluation of Hospital services
- Issues related to Healthcare technology
- Present trend in healthcare technology
- Problems & constraints
- Planning & adopting appropriate technology in healthcare
- Evaluation method of health technology Evolution of Quality management
- Quality assurance methods
- Patient satisfaction
- Standard operating procedure
- Quality certification
- Accreditation to national agencies

### **3. Biomedical Instrumentation**

**(20hrs)**

1. Introduction to Biomedical Instrumentation
  - a. The Age of Biomedical Engineering
  - b. Development of BM instrumentation
  - c. Biometrics

- d. Introduction to the man-instrumentssystem
  - e. Components of the man-instrumentssystem
  - f. physiological systems of thebody
  - g. Problems encountered in measuring a livingsystem.
2. Basic Transducerprinciples:
    - a. The transducer and transductionprinciples
    - b. Activetransducers
    - c. Passivetransducers
    - d. Transducers for Biomedicalapplications
  3. Sources of Bioelectricpotentials:
    - a. Resting and action potentials
    - b. Propagation of Actionpotentials
    - c. The Bioelectricpotentials
  4. Electrodes
    - a. Electrode theory
    - b. Biopotentialelectrodes
    - c. Biochemicaltransducers
  5. The computer in BiomedicalInstrumentation:
    - a. The digital computer - Computer Hardware, Computer software
    - b. Microprocessors - Types of microprocessors, Microprocessors in Biomedical Instrumentation-Calibration, Table lookup, Averaging, Formatting and printout
    - c. Interfacing the computer and medical instrumentation and other equipment.- Digital interfacing requirement , Analog-to-digital and Digital-to-Analogconversion
    - d. 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
  6. Electrical safety of Medical Equipment.
    - a. Physiological effects of electricalcurrent.
    - b. Shock hazards from electricalequipment.
    - c. Methods of accidentprevention
      - Grounding

- Doubleinsulation
- Protection by lowvoltage
- Ground – fault circuitinterrupter
- Isolation of patient – connectedparts
- Isolated power distributionsystems

7. Patient care andmonitoring:

- a. The elements of intensive – caremonitoring
  - Patient monitoring displays
- b. Diagnosis, calibration and reparability of patient – monitoring equipment
- c. Other instrumentation for monitoringpatients
- d. The organization of the hospital for patient caremonitoring
- e. Defibrillator

8. Description of Machine self test

9. Technical safety checks andmaintenance

- a. Generalnotes
- b. Technical safety checks and maintenanceprocedures
- c. maintenanc checklist

10. Adjustment

- a. Overview of the Dipswitches
- b. Calibrationmode
- c. Hydraulics
- d. Dirdetector

11. Calibration Program

12. Diagnostics Program

- a. General notes

13. Setup Menu

- a. Overview
- b. Main menu

14. Circuit diagram and circuitdescription

- a. Block diagram
- b. level detector control(LD)
- c. BLD
- d. Motherboard

- e. CPU
- f. Input / outputboard
- g. Displayboard
- h. Powersupply
- i. Hep -Module

**4. Molecular biology and biotechnology (40hrs)**

1. Introduction to molecularBiology
2. Concept
3. Basic principles ofBiotechnology
4. MolecularBiology
  - Identification of the genetic materials
  - Chemical nature of genetic materials
  - Replication ofDNA
  - Non-genetic ribonucleic Acid (RNA) andtranscription
  - Geneticcode
  - Protein synthesis
  - Regulation of geneaction
5. Recombinant DNA technology
  - Biology & classification of Cloning strategies & Vectors.
  - Introduction of genes into thecell
  - DNA modifying enzymes and DNAsynthesis
  - Genetic Recombination and Gene Transfer (Bacterial Conjugation, Transformation, Transduction, Episomes and Plasmids)
  - Genetic Engineering (Isolation, sequencing, Synthesis of Gene and DNA Fingerprinting)
  - Site DirectedMutagenesis.
  - AntisenseTechnology
  - Genetheraphy
6. Immunology
  - Antibody antigenreaction,
  - Hybridomatechnology
  - Vaccines production(Principles)
7. Stem cell research: principles andapplication

**Paper VII: Emergency Medicine /ACL Nephro-Radiological Nuclear Medicine and imaging sciences and Nephrophysiatric (60hrs)**

**1. Emergency medicine/ACLS/ renalnutrition (20hrs)**

**A. BLS (10hrs)**

1. BLS inperspective
  - a. The need for Medicalinterventions
  - b. The ultimate Coronary CareUnit
  - c. Emergency CardiacCare
  - d. The chain ofSurvival
  - e. Role of the American HeartAssociation
2. Cardio Pulmonary Function and actions forsurvival
  - a. The Cardiovascular and Respiratorysystem
  - b. Action forsurvival
3. Risk factors and prudent Heartliving
  - a. Risk factors for HeartAttack
  - b. Prudent HeartLiving
  - c. Summary: The role ofPrevention
4. Adult BLS
  - a. Citizen response to Cardio-pulmonaryEmergency
  - b. Indication forBLS
  - c. The sequence of BLS; Assessment, EMS activations and the ABC ofCPR
  - d. CPR performed by one rescuer and tworescuers
  - e. Foreign – Body airway obstructionManagement
  - f. CPR: The HumanDimension
  - g. BLS Research Initiative

## 5. Special Resuscitation Situation

- a. Stroke
- b. Hypothermia
- c. Near –Drowning
- d. Cardiac arrest associated withTrauma
- e. Electric shock and lightningstroke
- f. Pregnancy
- g. Asphyseration
- h. Special techniques and pitfalls andcomplication
- i. Uniquesituation

## 6. PediatricBLS

- a. Epidemiology
- b. Injuryprevention
- c. Prehospitalcare
- d. The sequence of Pediatric BLS - the ABC ofCPR
- e. Activation of the EMS systemobstructive
- f. Foreign Bodyairway
- g. BLS inTrauma

## 7. Ethical and Legalconsiderations

- a. Values in DecisionMaking
- b. Instituting and DiscontinuingCPR
- c. Legalmandates
- d. Conclusions
8. Safety during CPR Training and actual rescue
  - a. Disease transmission during CPRTraining
  - b. Disease transmission during actual performance ofCPR
9. Automated ExternalDefibrillation
  - a. Importance of Automated ExternalDefibrillation
  - b. Overview of Automated ExternalDefibrillation
  - c. Advantage and Disadvantage of Automated ExternalDefibrillation
  - d. Use of Automated External Defibrillation during Resuscitationattempts
  - e. Automated External Defibrillation treatmentalgorithm
  - f. Post resuscitationcare
  - g. Training
  - h. Maintenance ofSkills
  - i. Medicalcontrol
  - j. Quality assurance



**1. Cardiopulmonary Resuscitation and Advanced Cardiac Life Support**

- a. Basic Life Support
- b. General Considerations of Advanced Cardiac Life Support: Arrhythmia recognition and defibrillation-ventilation and airway management-route of drug administration-IV fluids-diagnose and correct the underlying cause of the arrest-internal cardiac compression-initiation and discontinuation of resuscitation.
- c. Specific Arrest Sequences in Advanced Cardiac Life Support : VF and Pulseless VT – Systole-Bradycardia-Pulseless electrical activity (PEA)-Tachycardias
- d. Post resuscitation Management
- e. Common Medications Used in Advanced Cardiac Life Support : Epinephrine-Atropine sulfate-Lidocaine- Procainamide hydrochloride-Bretylium tosylate-magnesium sulfate-adenosine-Diltiazem or verapamil-Isoproterenol-Sodium bicarbonate-Calcium

**2. Critical Care**

- a. Respiratory Failure: General considerations-pathophysiology-Blood gas analysis
- b. Oxygen therapy: Nasal prongs-venturi masks-Nonrebreathing masks-A continuous positive airway pressure mask-Bilevel positive airway pressure
- c. Airway Management and Tracheal Intubation: Airway Management-Endotracheal intubation-Surgical airways
- d. Mechanical Ventilation: Indications-Initiation of mechanical ventilation- Management of problems and complications-Weaning from mechanical ventilation-  
Drugs commonly used during endotracheal intubation and mechanical ventilation
- e. Shock: Resuscitative Principles-Individual shock states
- f. Hemodynamic Monitoring and Pulmonary Artery Catheterization: Indications-obtaining a pulmonary capillary wedge tracing-acceptance of PAOP readings-transmural pressure-Cardiac output-Interpretation of hemodynamic readings

**3. Cardiac Arrhythmias**

- a. Recognition and Management: Clinical diagnosis of arrhythmias-Electrocardiographic data-Bradycardias-premature complexes-Tachycardia-
- b. Antiarrhythmic Drug Therapy: General Principles-Antiarrhythmic agents
- c. Related Topics: Syncope-Electro-cardioversion-Cardiac pacing-Anti-tachycardia devices

**2. Nephro-radiological and imaging sciences and nuclear medicine (20hrs)**

**3. Radiological and Imaging Sciences (15hrs)**

1. Ultrasound Sonographic imaging characteristics
2. Doppler ultrasound – scanning techniques (ultrasound of the normal kidney – acute renal failure – surgical – medical renal disease – renal masses – cysts- solid renal masses – calculi – intrarenal hematomas – renal transplant evaluation – rejection – renal infections) Doppler ultrasound in evaluation of renal vascular disease and Transplant kidney evaluation.
3. Computed Tomography Of The Kidney: Anatomy – renal masses – cystic masses – solid renal masses – tumors of the renal pelvis – renal calculi – obstructive uropathy – infarction – acute renal cortical necrosis – renal vein thrombosis – renal artery stenosis – acute pyelonephritis – renal and perinephric abscess – emphysematous pyelonephritis – pyelonephrosis – xanthogranulomatous pyelonephritis – tuberculous pyelonephritis – congenital anomalies – renal trauma – transplant kidneys
4. Urography: intravenous urography – indications – contra indications – interpretation.
5. Magnetic Resonance Imaging: normal kidney – congenital anomalies – obstruction – injection – renal parenchymal disease – hypertension and renal vascular disease – renal cysts – benign neoplasm's – malignancies of kidney.
6. Renal Angiography: Indications – relative contraindications.
7. Renal Biopsy

**4. Nuclear Medicine (5hrs)**

1. Basic of nuclear medicine.
2. DTPA, DMSA.
3. Peritoneal scintigraphy.
4. Reflex scintigraphy.
5. Transplant renal scintigraphy.

**5. Nephropsychiatry (20hrs)**

1. Psychiatric Assessment
  - a. Introduction to clinical assessment
  - b. The Psychiatric interview
  - c. The mental status Exam
  - d. Physical Exam and laboratory evaluation
  - e. Intelligence testing and neuropsychological assessment
  - f. Personality assessment

2. Psychiatric Aspects of Renal Care
  - a. Introduction
  - b. Psychiatric problems: uncooperativeness-cause of uncooperativeness
  - c. Depression and Suicide, anxiety, rehabilitation problems, sexual problems
  - d. Psychiatric fitness for Transplantation
  - e. Treatment of psychiatric problems-preventive therapy-group therapies- environmental Manipulations-psychotherapy-pharmacotherapy-behavioral sexual techniques
3. Rehabilitation and Psychosocial Issues
  - a. Endurance Exercise training in hemodialysis patients
  - b. Psychosocial rehabilitation of Adult dialysis patients
  - c. Ethical Dilemmas in Dialysis: To initiate or withdraw Therapy
4. Mental Disorders
  - a. Diagnosis and classification in psychiatry
  - b. Psychiatry history and examination
  - c. Organic( Including Symptomatic) mental disorders
  - d. Psychoactive substance use disorders
  - e. Schizophrenia
  - f. Mood Disorders, Anxiety and personality
  - g. Other psychotic Disorders
  - h. Neurotic, stress-related and somatoform disorders
  - i. Disorders of Adult personality and behaviour
  - j. Sexual disorders
  - l. Sleep disorders
  - m. Behavioural syndromes associated with psychological disturbances and physiological factors
  - n. Mental retardation
  - o. Child psychiatry
  - p. Psychopharmacology
  - q. Biological methods of treatment
  - r. Psychoanalysis
  - s. Psychotreatment
  - t. Emergency psychiatry
  - u. Legal and ethical issues in psychiatry
  - v. Common psychiatry

## PRACTICALS

(2100hrs)

### 1. Patient Care

(400hrs)

#### A. Assessment

Collect & evaluate patient data

- Access Patency
- Apical pulse
- Blood pressure
- Breath sound
- Heart Sound
- Jugular vein distension
- Peripheral edema
- Pulse
- Respiration
- Signs of infection
- Temperature
- Weight
- Communication with patient

#### B. Pre dialysis procedures

a. Following HD orders and treatment plan

b. Equipment preparation procedures

- Preparing dialysate according
- Assembling the extracorporeal circuit
- Priming the dialyser & extracorporeal circuit
- Pre – initiation check

#### C. Initiation of Dialysis

a. Fluid removal procedures

- Calculating amount of fluid to be removed
- Predicting UF
- Calculating TMP
- Calculating UF rate
- Fluid replacement
- Isolated ultrafiltration

b. Venipuncture procedure

- Needle insertion in a fistula or graft
- Initiating dialysis treatment
- Clean & dress access site (venous cannulation) using appropriate technique

### c. Monitoring during dialysis

- Patient monitoring procedures
  - Taking vital signs
  - Monitoring general patient condition
  - Providing comfort and diversion during dialysis
- Technical monitoring
  - Monitoring devices
  - Equipment safety checks
  - Extracorporeal circuit
- Blood pump settings
- Adjust arterial & venous pressures
- Adjust fluid removal
- Monitor the dialysate delivery system
- Heparinisation during dialysis
- Recognize complications occurring during dialysis & their management
  - Chills
  - Cramps
  - Fever
  - Shock
- Recognize and management of complication due to operator & equipment error
  - Air embolism
  - Bleach or formaldehyde reaction
  - Chemical pyrogen reaction
  - Hemolysis and water quality
- Recognize problem regarding heparinisation (Coagulation, hemorrhage, hemostasis)
- Recognize access complication in patients (Clotting, infection, recirculation)
- Recognize blood leaks
- Recognize complication with administration of medication (Antihypertensive, Erythropoietin, iron dextran).

### D. Post Dialysis Procedures

- Completing dialysis treatment procedures
- Discontinuing dialysis
- Post dialysis pt. check
- Taking vital signs and weight
- Documentation
- Equipment clearing / disinfection

### E. Medications, solutions and laboratory test

#### a. Medications and solution procedures

- drawing solution
- Using I.V solutions

b. Laboratory tests procedures

- Drawing blood specimen
- Blood sampling pre & post dialysis (Bun measurements)
- Monitoring of anemia
- determining R.B.S
- Determining Kt/V, recirculation, URR, Aluminum level, blood chemistry, culture, hematocrits, hepatitis study, iron study.
- Perform coagulation studies to determine Heparinisation

c. Documenting patient care

- Treatment record

**2. Hemodialysis Catheterization Under Guidance (100hrs)**

- Types of catheter
- Choice of device
- Catheter placement
- Placement techniques
- Cut down techniques
- External jugular vein
- Internal jugular vein
- Femoral vein
- Placement under radiographic guidance
- Ultrasound

**3. Machine Technology (400hrs)**

Maintenance of system:

- Clean & disinfect dialysis equipments as per unit policy (Protocol)
- Develop preventive maintenance schedules for all dialysis equipment and maintain record
- Document all dialysis equipment repair work performed
- Maintain emergency equipment in proper working condition for immediate use
- Maintain / verify the calibration of HD machines
- Order supplies & equipment for dialysis unit perform repairs to equipment
- Perform electrical leakage tests for all dialysis equipments
- Verify blood & dialysate flow rate. Machine setup:

A. Assemble dialysis equipment for operation

B. Perform residual chemical checks

C. Perform required safety checks

- Conductivity
- pH
- Pressure holding test
- Temperature

D. Perform safety checks

- ABD (Air Bubble Detector)
- Arterial pressure gauge
- Blood leak alarm
- Blood pump
- Dialysis fluid
- Heparin pump
- Venous pressure gauge
- Dialysis check

E. Prepare bicarb solution

F. Prepare dialysis machine

- Rinse
- Prime
- Calibrate alarm
- Set monitor
- Fluid delivery system
- Connection

G. Perform Disinfection procedure of dialysis machine

**4. Water Treatment Plant**

**(250hrs)**

A. Continuous monitoring

- Temperature, pressure, flow rate, conductivity resistivity, total dissolved solids (TDS)

B. Periodic monitoring

- Softener regeneration
- Hardness test
- total chlorine, chloramine test
- chemical analysis
- pH
- Others Microbiological tests
- Disinfection
- Culture
- Record maintenance

Dialyser processing	<b>(30hrs)</b>
<ul style="list-style-type: none"> <li>- Process dialyser according to protocol</li> <li>- Maintain processing record</li> <li>- Perform reuse test <ul style="list-style-type: none"> <li>• Bacterial culture</li> <li>• Presence of disinfectant</li> <li>• Pressure testing</li> <li>• Visual inspection</li> </ul> </li> </ul>	
Electronics	<b>(30hrs)</b>
<ul style="list-style-type: none"> <li>- Components</li> <li>- Relationship – voltage, amperage, resistance</li> <li>- Basic multimeter skills</li> <li>- Concepts <ul style="list-style-type: none"> <li>• Transformer</li> <li>• Relays</li> </ul> </li> <li>- Reading wiring diagram /schematics</li> <li>- Electrical safety</li> <li>- Handling P.C boards</li> <li>- Soldering skills</li> </ul>	
Computers	<b>(20hrs)</b>
<ul style="list-style-type: none"> <li>- Cabling</li> <li>- Operating system</li> <li>- Computer components</li> </ul>	
Plumbing	<b>(20hrs)</b>
<ul style="list-style-type: none"> <li>• Fittings</li> <li>• Sizes</li> <li>• Materials</li> </ul>	
Management of dialysis unit	<b>(50hrs)</b>
Special and advanced dialysis procedures	<b>(100hrs)</b>
Peritoneal dialysis	<b>(90hrs)</b>
Cpr demo	<b>(10hrs)</b>
Teaching methodology	<b>(600hrs)</b>
Distribution of marks for the first year	



## **Subsidiary Subject Ethics - 10 Hrs**

**(Should be taught to the 1st year students)**

**Introduction:** With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare them to deal with these problems. Other professionals are confronted with many ethical problems.

Standards of professional conduct are necessary in the public interest to ensure an efficient laboratory service. Every sinologists or sonographer should not only be willingly to play his part in giving such a service, but should also avoid any act or omission which would prejudice the giving of the services or impair confidence, in respect, for sinologists or sonographer as a body.

To accomplish this and develop human values, it is desired that all the students undergo ethical sensitization by lectures or discussion on ethical issues.

### **Introduction to ethics-**

What is ethics?

General introduction to Code of Laboratory Ethics

How to form a value system in one's personal and professional life? International code of ethics

### **Professional Ethics-** Code of conduct Confidentiality

Fair trade practice Handling of prescription

Mal practice and Negligence Professional vigilance

### **Research Ethics-**

Animal and experimental research/ humanness Human experimentation Human volunteer research - informed consent Clinical trials

Gathering all scientific factors Gathering all value factors

Identifying areas of value – conflict, setting priorities Working out criteria towards decision

ICMR/ CPCSEA/ INSA Guidelines for human / animal experimentation

### **Suggested Readings :**

- Human Anatomy - B.D.Chaurasia
- Gray's Anatomy for the students – Richard L. Drake
- Human Physiology - A.K.Jain
- Anatomy and physiology in health and illness – Ross and Willson
- Text Book of Pathology - Harsh Mohan
- Basic Pathology – pocket Robbins
- Medical Pharmacology – Padmaja Uday Kumar
- KD Tripathi – Essentials of Medical Pharmacology
- The Kidney – By Barry Brenner, Floyd

- Clinical Dialysis, Dialysis Therapy- By Nissenson, Fine
  - Complications of dialysis- By Norbert Lemeire, Ravindra Mehta
  - Dialysis technology- By Jim Curtis , Philip Varughese
  - Hand book of dialysis – By Daugirdas, Peter Gerard Blake
  - Renal Nursing – By Nicola Thomas
  - Review of HD – By C.F. Butch, Martha H Stoner, Anna L. Corea
1. Some are from internet sources.
  2. Lwanga SK and Cho-Yook Tye (Editors). Teaching Health Statistics, Twenty lessons and seminar outlines, World Health Organization, Geneva.
  3. Mahajan BK. Methods in Biostatistics for medical students and research workers. 6th Edition, Jaypee Brothers Medical Publishers, New Delhi, 1997.
  4. Kothari CR. Research Methodology: Methods and Techniques. Wiley Eastern Ltd, New Delhi.
  5. Sundar Rao P55 and Richard J. Introduction to Biostatistics: A Manual for Students in Health Sciences. Prentic-Hall of India Pvt. Ltd, New Delhi.
  6. Park E. Park's Text book of Preventive and Social Medicine, M/S Banarasidas Bhanot, Jabalpur.
  7. Nair S K. Essential Research Methodology, Epidemiology and Biostatistics. In: Shobha Tandon, editor. Text Book of Pedodontics, 2~ ed. Hyderabad: Paras Publishing; 2001 p 687-96.
  8. Armitage P, Berry G. Statistical methods in medical research, 3rd ed. London: Blackwell Scientific Publications; 1994.
  9. Daniel W W. Biostatistics: A foundation for analysis in health sciences, 2nd ed. New York; John Wiley and Sons, 1987.
  10. Principles of Management by Koontz 'o' Donnell
  11. Hospital planning Administration by B.M. Shakar

## MODEL QUESTION PAPER

### THEORY

Each theory paper will have

- 1) Essay questions – 03 nos. carrying 10 marks each -  $03 \times 10 = 30$
- 2) Short **answer questions** – **10 nos. carrying 05 marks each -  $10 \times 05 = 50$**   
Total = 80  
Internal assessment = 20

### PRACTICAL

- (a) Preliminary:  
Internal assessment : 15  
University examination : 60  
Total = 75
- (b) Viva = 25

## MODEL PAPER

M.Sc. Dialysis technology  
Part-I (Main) Examination month year

### Paper I BASIC SCIENCES AND CLINICAL NEPHROLOGY

**Time: Three Hours**

**Maximum Marks: 100**

*Students shall be allowed to take only one supplementary copy long with one main answer book. All the parts of one question should be answered at one place. Different parts of one question should not be answer at different places in the answer book*

**Attempt all Questions.**

Q.1	Describe gross and microscopic anatomy of kidney	25
Q.2	Approach to a patient presenting with Acute Kidney Injury	25
Q.3	Long answers	
	a) Chronic Kidney Disease	12½
	b) Immunosuppression in Transplantation	12½
Q.4	Short Notes	5x5=25
	a) Renal hormones	
	b) Metabolic acidosis	
	c) Classical Complement pathway	
	d) Hyperkalemia	
	e) Major Histocompatibility Complex	

## MODEL PAPER

M.Sc. DIALYSIS TECHNOLOGY  
Part-I (Main) Examination month year

### Paper-II

#### BASIC PRINCIPLES AND OVERVIEW OF TYPES OF RRT(HD AND PD)

**Time: Three Hours**

**Maximum Marks: 100**

*Students shall be allowed to take only one supplementary copy long with one main answer book. All the parts of one question should be answered at one place. Different parts of one question should not be answer at different places in the answer book*

**Attempt all Questions.**

- |     |   |        |
|-----|---|--------|
| Q.1 | Explain in detail the dialyzer machine, dialyzer fluid other components | 25     |
| Q.2 | Describe the anticoagulation drugs for hemodialysis                     | 25     |
| Q.3 | Long answers Type   |        |
|     | a) Indication of Renal Replacement therapy                              | 12½    |
|     | b) Peritoneal Dialysis  | 12½    |
| Q.4 | Short Notes   | 5x5=25 |
|     | a) Adequacy of HD   |        |
|     | b) Antibiotic usage with HD   |        |
|     | c) AV shunt   |        |
|     | d) Complications with central venous access                             |        |
|     | e) Management of anemia in CKD  |        |

**MODEL PAPER**

**M.Sc. DIALYSIS TECHNOLOGY**

**Part-I (Main) Examination month year**

**Paper-III**

**EPIDEMIOLOGY AND BIostatISTICS**

**Time: Three Hours**

**Maximum Marks: 100**

*Students shall be allowed to take only one supplementary copy long with one main answer book. All the parts of one question should be answered at one place. Different parts of one question should not be answer at different places in the answer book*

**Attempt all Questions.**

Q.1	Describe the various techniques of sampling	25
Q.2	Describe the various types of study designs	25
Q.3	Long answers Type	
	a) Comparative tests for qualitative data	12½
	b) Determination of sample size for observational study	12½
Q.4	Short Notes	5x5=25
	a) P value	
	b) Regression analysis	
	c) Clinical trial Registration	
	d) Cochrane Library	
	e) Reliability and Precision	

## MODEL PAPER

M.Sc. Med.Phy.– II

Short Name

M.Sc. DIALYSIS TECHNOLOGY

Part-II (Main) Examination month year

Paper-I

**RECENT ADVANCE HD PROCEDURES AND COMPLICATIONS IN RENAL  
D/S PTS AND RENAL NUTRITION**

**Time: Three Hours**

**Maximum Marks: 100**

*Students shall be allowed to take only one supplementary copy long with one main answer book. All the parts of one question should be answered at one place. Different parts of one question should not be answer at different places in the answer book*

**Attempt all Questions.**

- |     |   |        |
|-----|---|--------|
| Q.1 | Describe in detail the nutritional management for patient on HD | 25     |
| Q.2 | Describe the complications associated with long term HD         | 25     |
| Q.3 | Long answers Type   |        |
|     | a) Calcium balance in normal person versus CKD patient          | 12½    |
|     | b) Fluid Dynamics in HD   | 12½    |
| Q.4 | Short Notes   | 5x5=25 |
|     | a) Creatinine Clearance   |        |
|     | b) Recommended Dietary Allowance                                |        |
|     | c) Indices of protein assessment                                |        |
|     | d) Cyber Nephrology   |        |
|     | e) Telemedicine In HD   |        |

## MODEL PAPER

M.Sc. Med.Phy.– II

Short Name

M.Sc. DIALYSIS TECHNOLOGY

Part-II (Main) Examination month year

Paper-II

MANAGEMENT OF DIALYSIS UNIT AND BIOMEDICAL  
INSTRUMENTATION BIOTECHNOLOGY AND MOLECULAR BIOLOGY

**Time: Three Hours**

**Maximum Marks: 100**

*Students shall be allowed to take only one supplementary copy long with one main answer book. All the parts of one question should be answered at one place. Different parts of one question should not be answer at different places in the answer book*

**Attempt all Questions.**

- Q.1 Describe the manpower and equipment setup of a Dialysis ward in your hospital 25
- Q.2 Describe how will you counsel a patient and his family members on long term HD 25
- Q.3 Long answers Type
- a) Biomedical engineering 12½
  - b) Patient monitoring in dialysis ward 12½
- Q.4 Short Notes 5x5=25
- a) Quality assurance methods in dialysis ward
  - b) Biometrics
  - c) Microprocessors
  - d) Structure of DNA and genetic code
  - e) Genetic recombination



## MODEL PAPER

M.Sc. Med.Phy.– II

Short Name

M.Sc. DIALYSIS TECHNOLOGY

Part-II (Main) Examination month year

Paper-III

**EMERGENCY MEDICINE/ACL NEPHRO-RADIOLOGICAL,NUCLEAR  
MEDICINE AND IMAGING SCIENCES NEPHROPSYCHIARTY**

**Time: Three Hours**

**Maximum Marks: 100**

*Students shall be allowed to take only one supplementary copy long with one main answer book. All the parts of one question should be answered at one place. Different parts of one question should not be answer at different places in the answer book*

**Attempt all Questions.**

- |     |   |        |
|-----|---|--------|
| Q.1 | Describe adult BLS  | 25     |
| Q.2 | Describe the various cardiac rhythms seen in critical ill patients and their management | 25     |
| Q.3 | Long answers Type   |        |
|     | a) Nuclear imaging of kidneys   | 12½    |
|     | b) Fluid management in critical ill patient   | 12½    |
| Q.4 | Short Notes   | 5x5=25 |
|     | a) Hypothermia  |        |
|     | b) Definitive airway  |        |
|     | c) Automated external defibrillator   |        |
|     | d) Mood disorders of CKD patients   |        |
|     | e) Nephrogenic systemic Fibrosis  |        |