



SEMESTER – II

PAPER CODE	SUBJECT NAME	THEORY HOURS	PRACTICAL HOURS	THEORY MARKS	PRACTICAL MARKS
DDT201	DIALYSIS PRINCIPLES AND TECHNIQUES	45 Min	1 Hrs.	50	50
DDT202	MICROBIOLOGY	45 Min	1 Hrs.	50	50
DDT203	DIALYSIS MANAGEMENT	45 Min	1 Hrs.	50	50
DDT204	GENERAL MEDICINE	45 Min	1 Hrs.	50	50

DIALYSIS PRINCIPLES AND TECHNIQUES

THEORY

1. Introduction to Dialysis

- Definition and history of dialysis.
- Need and scope of dialysis in kidney diseases.
- Renal replacement therapy: Hemodialysis, Peritoneal dialysis, Kidney transplantation (basic overview).
- Role of dialysis technician.

2. Physiology and Pathophysiology Related to Dialysis

- Review of renal anatomy & physiology.
- Kidney functions (filtration, secretion, reabsorption, endocrine).
- Pathophysiology of Acute Kidney Injury (AKI) & Chronic Kidney Disease (CKD).
- Fluid and electrolyte balance.
- Acid–base balance and its disturbances in renal failure.

3. Principles of Dialysis

- Concept of diffusion, osmosis, ultrafiltration, convection.
- Solute transport across membranes.
- Clearance and dialysis adequacy (Kt/V, URR – basics).
- Dialysate composition and its role.

4. Hemodialysis Techniques

- Hemodialysis machine: structure, components, functions.
- Types of dialyzers (hollow fiber, parallel plate, high flux vs low flux).
- Vascular access: arteriovenous fistula, grafts, central venous catheters.
- Steps in hemodialysis procedure.



- Anticoagulation in dialysis (Heparin, citrate – basics).
- Complications of hemodialysis (hypotension, cramps, clotting, air embolism, disequilibrium syndrome).
- Monitoring during dialysis: BP, pulse, weight, fluid removal.

5. Peritoneal Dialysis

- Principle and mechanism of peritoneal dialysis.
- Peritoneal membrane physiology.
- Types: Continuous Ambulatory Peritoneal Dialysis (CAPD), Automated Peritoneal Dialysis (APD).
- Equipment and dialysate used.
- Procedure of CAPD (steps).
- Complications: peritonitis, infection, catheter malfunction, fluid imbalance.

6. Water Treatment and Dialysis Fluids

- Importance of water quality in dialysis.
- Steps in water purification: filtration, softening, reverse osmosis.
- Standards for water and dialysate (AAMI / ISO basics).
- Composition and preparation of dialysate.

7. Dialysis Unit Setup and Management

- Layout of dialysis unit.
- Disinfection and sterilization procedures.
- Biomedical waste disposal in dialysis unit.
- Infection control practices (universal precautions, handling of blood-borne pathogens like HBV, HCV, HIV).
- Record keeping and patient data management.

8. Medications in Dialysis

- Common drugs used in dialysis patients:
 - Antihypertensives.
 - Erythropoietin.
 - Iron supplements.
 - Phosphate binders.
 - Vitamin D analogues.
- Anticoagulants in dialysis.

9. Dialysis Emergencies & Troubleshooting

- Recognition and management of complications:
 - Hypotension, arrhythmias.
 - Anaphylaxis, allergic reactions.
 - Blood loss, hemolysis.
- Troubleshooting dialysis machine alarms.
- Power failure and emergency preparedness.



10. Recent Advances in Dialysis

- High-flux hemodialysis.
- Hemodiafiltration.
- Sorbent dialysis systems.
- Wearable and portable dialysis devices.

11. Professional and Ethical Aspects

- Role of dialysis technician in patient care.
- Patient communication and counseling.
- Ethical issues in dialysis practice.
- Teamwork with nephrologists and nurses.

PRACTICAL

➤ Orientation & Safety

- Familiarization with dialysis unit layout and equipment.
- Universal precautions – hand hygiene, gloves, PPE use.
- Biomedical waste disposal in dialysis unit.
- Disinfection of dialysis machines and unit area.

➤ Hemodialysis Machine Handling

- Identification of machine parts and their functions.
- Switching on/off and priming of machine.
- Setting up bloodlines and dialyzer.
- Checking alarms and troubleshooting basics.
- Recording machine parameters.

➤ Water Treatment System

- Demonstration of water purification (sand filter, carbon filter, softener, RO system).
- Checking conductivity, hardness, and chlorine levels in water.
- Disinfection and maintenance of RO plant.

➤ Vascular Access

- Identification of different vascular access (AV fistula, graft, catheter).
- Preparation of patient and site for cannulation.
- Cannulation technique (demonstration + practice on dummy/under supervision).
- Care and maintenance of vascular access.

➤ Hemodialysis Procedure

- Pre-dialysis assessment: history, weight, BP, pulse, temperature.



- Priming of dialyzer and bloodline.
- Connection of patient to machine.
- Monitoring during dialysis (vital signs, UF, blood flow, dialysate flow).
- Termination of dialysis and reinfusion of blood.
- Post-dialysis assessment and recording.

➤ **6. Peritoneal Dialysis**

- Identification of CAPD/APD equipment and dialysate.
- Demonstration of CAPD exchange procedure.
- Care of PD catheter and site dressing.
- Recognition of complications (peritonitis, leakage, blockage).

➤ **Patient Monitoring & Care**

- Measurement of dry weight and calculation of fluid removal.
- Monitoring electrolyte balance and symptoms of imbalance.
- Managing hypotension, cramps, nausea during dialysis.
- Recording and maintaining patient dialysis charts.

➤ **Infection Control**

- Screening procedures for HBV, HCV, HIV in dialysis patients.
- Cleaning and disinfection of machines after infected patient dialysis.
- Sterilization of equipment.

➤ **Emergency & Troubleshooting**

- Management of air embolism (demonstration).
- Handling machine alarms (air detector, venous pressure, arterial pressure).
- Power failure and emergency procedures.
- Basic life support (BLS) and CPR demonstration.

➤ **Case Studies & Report Interpretation**

- Interpretation of dialysis adequacy (Kt/V, URR – basics).
- Reading and understanding lab reports (urea, creatinine, electrolytes, HB).
- Correlation of patient condition with dialysis outcome.

MICROBIOLOGY

THEORY

1. Introduction to Microbiology

- History and scope of microbiology.
- Importance of microbiology in health sciences and dialysis practice.
- Structure and classification of microorganisms (bacteria, viruses, fungi,



- parasites).
- Microscopy – types (light, electron, phase contrast – basic).
- Sterilization and disinfection – principles and methods.

2. General Bacteriology

- Structure and morphology of bacteria.
- Growth and nutrition of bacteria.
- Bacterial spores, toxins, and enzymes.
- Culture media and culture techniques (aerobic & anaerobic).
- Staining techniques: Gram stain, Acid-fast stain.
- Bacterial genetics (plasmid, mutation, resistance – basics).

3. Immunology and Infection Control

- Innate and acquired immunity.
- Antigens, antibodies, and antigen–antibody reactions.
- Vaccines and immunization (importance in dialysis patients: Hepatitis B, Influenza, COVID, etc.).
- Infection transmission routes (airborne, bloodborne, waterborne).
- Universal precautions and bio-safety measures in dialysis unit.

4. Systemic Bacteriology

(Study of important bacteria relevant to dialysis/healthcare)

- *Staphylococcus aureus* (MRSA).
- *Streptococcus* spp.
- *Enterococcus*.
- *Escherichia coli*, *Klebsiella*, *Pseudomonas*, *Proteus*.
- *Mycobacterium tuberculosis*.
- *Salmonella*, *Shigella*.
- Pathogenic bacteria causing sepsis, pneumonia, urinary tract infections.

5. Virology

- General properties of viruses.
- Important human viruses:
 - Hepatitis viruses (A, B, C, D, E).
 - HIV.
 - Influenza virus.
 - SARS-CoV-2 (COVID-19).
- Viral infections relevant to dialysis patients (HBV, HCV, HIV screening).

6. Mycology (Fungal Infections)

- Classification of fungi.
- Superficial, subcutaneous, systemic mycoses.



- *Candida* infections (important in immunocompromised/dialysis patients).
- Laboratory diagnosis of fungal infections.

7. Parasitology

- Introduction and classification of parasites.
- Protozoa: *Entamoeba histolytica*, *Giardia*, *Plasmodium* (malaria).
- Helminths: *Ascaris*, *Hookworm*, *Filaria*.
- Opportunistic parasitic infections in immunocompromised patients.

8. Applied Microbiology in Dialysis

- Sources of infection in dialysis unit.
- Water-borne infections (importance of RO water in dialysis).
- Blood-borne pathogens (HBV, HCV, HIV).
- Nosocomial infections and their prevention.
- Sterilization and disinfection of dialysis equipment and environment.
- Hand hygiene and biomedical waste management.

9. Diagnostic Microbiology

- Collection, transport, and processing of clinical specimens (blood, urine, sputum, pus, swabs).
- Blood culture and sensitivity testing.
- Urine culture and sensitivity.
- Rapid diagnostic tests (HIV, HBV, HCV kits).
- Antibiotic susceptibility testing and importance of antimicrobial stewardship.

10. Recent Advances

- Molecular diagnostic techniques: PCR, ELISA (basic overview).
- Emerging infections relevant to dialysis (COVID-19, multidrug-resistant bacteria).
- Advances in infection control policies in dialysis units.

PRACTICAL

➤ Laboratory Orientation & Safety

- Introduction to microbiology laboratory equipment (microscope, autoclave, hot air oven, laminar air flow).
- Preparation, handling, and sterilization of glassware and media.
- Universal precautions and biosafety measures.
- Biomedical waste disposal (color coding, sharp disposal).

➤ Microscopy & Staining Techniques

- Use and handling of compound microscope.
- Preparation and observation of wet mount.



- Gram staining of bacteria (differentiation of Gram-positive & Gram-negative).
- Acid-fast staining (*Mycobacterium* demonstration).
- Simple and negative staining.

➤ **Culture Techniques**

- Preparation of culture media (nutrient agar, blood agar, MacConkey agar – demonstration).
- Inoculation methods: streak, spread, pour plate.
- Aerobic vs anaerobic culture demonstration.
- Observation of colony morphology.

➤ **Bacterial Identification**

- Motility test (hanging drop method – demonstration).
- Biochemical tests (demo/perform as feasible):
 - Catalase test.
 - Coagulase test.
 - Oxidase test.
 - Indole, MR, VP, Citrate tests.
 - Urease test, TSI test.

➤ **Applied Microbiology in Dialysis**

- Demonstration of swab culture from dialysis unit surfaces.
- Water sample testing for bacterial contamination (coliform count demo).
- Screening tests for HBV, HCV, HIV (rapid card/ELISA demo).
- Hand swab culture to demonstrate infection control importance.

➤ **Mycology (Fungal Studies)**

- Preparation of KOH mount for fungi.
- Observation of *Candida* spp. and molds (prepared slides).
- Culture demonstration on Sabouraud's agar.

➤ **Parasitology**

- Wet mount preparation of stool sample (demo).
- Identification of common parasites/ova/cysts using prepared slides (*Entamoeba*, *Giardia*, *Ascaris*, *Hookworm*).

➤ **Immunology Practicals**

- Demonstration of antigen–antibody reactions (slide agglutination, latex agglutination).
- Widal test (demonstration for *Salmonella*).
- VDRL test (demo).

➤ **Antibiotic Sensitivity Testing**



- Kirby-Bauer disc diffusion method demonstration.
- Interpretation of zones of inhibition.
- Understanding multidrug resistance (MRSA, ESBLs).

➤ **Disinfection & Sterilization**

- Demonstration of autoclaving and hot air oven.
- Filtration method (membrane filter demonstration).
- Chemical disinfectants used in dialysis unit (chlorine, formaldehyde, alcohol).
- Sterility testing methods (demo).

DIALYSIS MANAGEMENT

THEORY

1. Introduction to Dialysis Management

- Concept and scope of dialysis management.
- Role and responsibilities of dialysis technician.
- Importance of teamwork (technicians, nurses, nephrologists, support staff).

2. Dialysis Unit Organization

- Dialysis unit layout and infrastructure.
- Manpower requirement and duties.
- Patient scheduling and flow management.
- Patient education and counseling.
- Emergency preparedness in dialysis unit.

3. Patient Evaluation & Monitoring

- Pre-dialysis patient assessment (history, vitals, lab reports).
- Assessment of fluid status (weight, edema, BP).
- Monitoring during dialysis (vital signs, alarms, UF, complications).
- Post-dialysis evaluation (weight, symptoms, lab review).
- Patient record keeping and data management.

4. Vascular Access Care

- Types of vascular access (AV fistula, graft, central venous catheter).
- Pre- and post-cannulation care.
- Recognition and management of access complications (infection, thrombosis, poor flow).
- Access care education for patients.

5. Infection Control in Dialysis Unit

- Sources of infection in dialysis centers.



- Universal precautions and hand hygiene.
- Cleaning and disinfection of dialysis machines.
- Separation of Hepatitis B, C, HIV-positive patients.
- Biomedical waste management and disposal.
- Sterility and microbiological monitoring of water.

6. Water Treatment & Dialysate Management

- Water quality standards (AAMI/ISO).
- Dialysis water purification system (RO, filters, carbon).
- Regular monitoring and maintenance of water plant.
- Preparation, storage, and handling of dialysate concentrates.

7. Medication Management in Dialysis Patients

- Commonly used drugs in dialysis units (Erythropoietin, iron, phosphate binders, antihypertensives).
- Anticoagulation protocols (heparin, citrate).
- Drug administration routes during dialysis.
- Patient education regarding medicines.

8. Complications and Emergency Management

- Recognition and management of common complications:
 - Hypotension, cramps, nausea, vomiting.
 - Dialyzer reaction, allergic reactions.
 - Air embolism, hemolysis, clotting.
- Emergency protocols (BLS, CPR, anaphylaxis management).
- Fire safety and disaster preparedness in dialysis unit.

9. Quality Assurance & Audit

- Dialysis adequacy monitoring (Kt/V, URR – basics).
- Machine maintenance schedules.
- Record keeping and audit trails.
- Government guidelines and accreditation standards for dialysis units.

10. Counseling & Communication Skills

- Patient counseling on diet, fluids, lifestyle.
- Communication skills with patients and families.
- Handling anxious or uncooperative patients.
- Ethical and legal issues in dialysis care.

11. Recent Advances in Dialysis Management

- Tele-monitoring and e-record systems.
- Home dialysis (CAPD, home hemodialysis).
- Newer disinfectants and infection control protocols.



- Emerging global guidelines in dialysis care.

PRACTICAL

➤ **Dialysis Unit Orientation & Safety**

- Dialysis unit tour: patient waiting area, dialysis stations, isolation rooms.
- Familiarization with dialysis machine logbook and patient records.
- Demonstration of biomedical waste segregation and disposal.
- Fire safety, evacuation drills, and emergency preparedness.

➤ **Patient Management Skills**

- Pre-dialysis assessment: weight, BP, pulse, temperature, edema check.
- History taking and patient interview practice.
- Patient education: diet, fluid restriction, access care.
- Post-dialysis assessment and counseling.

➤ **Vascular Access Care**

- Observation and demonstration of AV fistula/graft site care.
- Steps of safe cannulation (on dummy or under supervision).
- Catheter care: dressing, flushing, infection prevention.
- Recognition of complications (swelling, redness, poor flow).

➤ **Dialysis Session Management**

- Preparing dialysis machine and patient records before procedure.
- Connecting patient safely to machine.
- Monitoring vital signs every 30–60 minutes.
- Documentation of UF (ultrafiltration), blood flow rate, dialysate flow rate.
- Disconnection and post-procedure care.

➤ **Infection Control**

- Demonstration of hand hygiene (WHO technique).
- Cleaning and disinfection of dialysis machine post-use.
- Surface swab collection for culture (demo).
- Handling HBV/HCV/HIV positive patient dialysis.
- Sterility testing of RO water (demonstration).

➤ **Water Treatment & Dialysate Management**

- Routine checks of RO system (conductivity, chlorine, hardness).
- Demonstration of RO water disinfection.
- Checking and preparing dialysate concentrate.
- Maintaining water quality logbook.

➤ **Medication Handling in Dialysis**



- Preparation and administration of heparin (demo).
- Iron and erythropoietin injection handling (demo).
- Recording medicines given during dialysis.

➤ **Complication & Emergency Handling**

- Recognition and immediate action for:
 - Hypotension, cramps, nausea, vomiting.
 - Blood leak alarm, air bubble alarm.
 - Anaphylactic reaction (demo with mannequin).
- BLS & CPR training on mannequin.
- Simulation: power failure during dialysis.

➤ **Records & Quality Assurance**

- Maintaining dialysis charts (daily).
- Preparing monthly patient dialysis summary.
- Machine maintenance checklist.
- Preparing infection audit and water quality reports.

➤ **Communication & Counseling**

- Role-play for patient counseling (diet, fluid, lifestyle).
- Handling an anxious/uncooperative patient (simulation).
- Ethical and legal case discussions.

GENERAL MEDICINE

THEORY

1. Introduction to General Medicine

- Scope and importance of General Medicine in dialysis.
- Role of dialysis technician in recognizing medical problems.
- Basic medical terminology.

2. History Taking & Clinical Examination

- Methods of history taking (chief complaints, past history, drug history).
- General physical examination (appearance, posture, hydration).
- Vital signs: temperature, pulse, respiration, blood pressure.
- Basic systemic examination (CVS, RS, CNS, GIT, urinary system).

3. Common Medical Disorders Relevant to Dialysis



a)

b) Renal System

- Acute Kidney Injury (AKI): causes, symptoms, management overview.
- Chronic Kidney Disease (CKD): stages, symptoms, complications.
- End-Stage Renal Disease (ESRD).
- Nephrotic and nephritic syndrome.
- Urinary tract infections.

c) Cardiovascular System

- Hypertension (primary & secondary).
- Ischemic heart disease, myocardial infarction (basics).
- Heart failure and its relation to CKD.
- Arrhythmias (overview).

d) Respiratory System

- Chronic obstructive pulmonary disease (COPD).
- Bronchial asthma.
- Pulmonary edema (common in CKD).
- Pneumonia and respiratory infections.

e) Endocrine & Metabolic Disorders

- Diabetes mellitus: types, complications (especially diabetic nephropathy).
- Thyroid disorders (hypo/hyperthyroidism).
- Electrolyte imbalance: hyperkalemia, hypocalcemia, acidosis/alkalosis.

f) Hematology

- Anemia in CKD.
- Coagulation disorders (bleeding, clotting tendencies).

g) Gastrointestinal & Hepatic Disorders

- Viral hepatitis B & C (importance in dialysis patients).
- Liver cirrhosis.
- Peptic ulcer disease, gastritis.

h) Infections

- Sepsis.
- Tuberculosis.
- HIV/AIDS (overview and precautions in dialysis).

4. Neurology



- Stroke (CVA) basics.
- Peripheral neuropathy in diabetes & CKD.
- Seizure disorders (overview).

5. Musculoskeletal & Bone Disorders

- Renal osteodystrophy.
- Osteoporosis and fractures in CKD patients.
- Gout and arthritis (relation with uric acid levels).

6. Skin & Immune Disorders

- Pruritus in CKD patients.
- Allergic reactions.
- Autoimmune diseases (SLE, vasculitis – overview).

7. Medical Emergencies (Dialysis-Related)

- Hypotension during dialysis.
- Hypertensive crisis.
- Hypoglycemia and hyperglycemia.
- Anaphylaxis and allergic reactions.
- Fluid overload and pulmonary edema.
- Electrolyte emergencies (e.g., hyperkalemia).

8. Pharmacology in General Medicine

- Common drugs in CKD patients (antihypertensives, diuretics, erythropoietin, iron therapy, phosphate binders).
- Drug dose modification in renal failure.
- Nephrotoxic drugs (NSAIDs, aminoglycosides, contrast agents).

9. Nutrition in Medicine

- Dietary management in CKD patients.
- Low-salt, low-potassium, and fluid-restricted diets.
- Role of protein in dialysis patients.

10. Preventive Medicine & Patient Education

- Vaccination in CKD patients (Hepatitis B, Influenza).
- Lifestyle modification (diet, exercise, smoking/alcohol cessation).
- Patient counseling on compliance with medicines and dialysis.

PRACTICAL

➤ General Examination Skills



- Measurement of **vital signs**:
 - Temperature (oral, axillary, digital).
 - Pulse (rate, rhythm, volume).
 - Blood pressure (manual and digital sphygmomanometer).
 - Respiratory rate.
- Recording weight, BMI, hydration status.
- General physical inspection: pallor, cyanosis, edema, icterus, lymph nodes.

➤ **Systemic Examination (Demonstrations & Practice)**

- **Cardiovascular system**: pulse examination, BP recording, heart sounds (demo).
- **Respiratory system**: respiratory rate, chest expansion, use of stethoscope for breath sounds.
- **Abdomen**: inspection, palpation for liver, spleen enlargement.
- **Nervous system (basic)**: consciousness level (GCS), reflex demo.
- **Musculoskeletal system**: joint mobility, swelling, deformities.

➤ **Clinical Case Discussions**

- Case presentation of **CKD patient**.
- Case discussion of **Hypertension**.
- Case study on **Diabetes with nephropathy**.
- Case discussion of **Anemia in CKD**.
- Group discussion: **Infection control in hepatitis/HIV-positive patients**.

➤ **Laboratory Investigations (Observation & Interpretation)**

- Interpretation of **CBC** (anemia detection).
- Renal function tests (urea, creatinine).
- Electrolyte report interpretation (Na^+ , K^+ , Ca^{2+}).
- Blood sugar monitoring (glucometer demo).
- Urine routine (protein, sugar, microscopic demo).

➤ **Patient Care & Monitoring**

- Pre-dialysis assessment: vitals, edema check, breathlessness.
- Monitoring patients during dialysis (BP charting every 30–60 min).
- Post-dialysis assessment (weight, BP, symptoms).
- Documentation in dialysis chart.

➤ **Medical Emergency Handling (Simulation & Demo)**

- Recognition and management of:
 - Hypotension during dialysis.
 - Hypertensive crisis.
 - Hypoglycemia (glucometer check, giving glucose).
 - Shortness of breath / pulmonary edema (oxygen support demo).
 - Seizure management (positioning, airway care).



- Anaphylactic reaction (emergency protocol demo).
- **BLS & CPR** training on mannequin.
- **Pharmacology (Practical Exposure)**
 - Demonstration of insulin injection technique (subcutaneous).
 - Heparin handling (precautions, dosage, demo).
 - Safe handling of erythropoietin, iron injections.
 - Recording drug administration in patient file.
- **Nutrition & Counseling**
 - Demonstration of fluid balance chart (intake vs output).
 - Patient diet chart preparation (low salt, low potassium diet).
 - Counseling practice:
 - Diabetic patient on diet & lifestyle.
 - CKD patient on fluid restriction.
- **Record Keeping & Documentation**
 - Maintaining patient history sheet.
 - Dialysis chart filling (BP, UF, complications).
 - Preparing discharge summary under supervision