



SEMESTER – I

PAPER CODE	SUBJECT NAME	THEORY HOURS	PRACTICAL HOURS	THEORY MARKS	PRACTICAL MARKS
DDT101	ANATOMY & PHYSIOLOGY	45 Min	1 Hrs.	50	50
DDT102	BASICS OF DIALYSIS TECHNIQS	45 Min	1 Hrs.	50	50
DDT103	BIOCHEMISTRY	45 Min	1 Hrs.	50	50
DDT104	PATHOLOGY	45 Min	1 Hrs.	50	50

ANATOMY & PHYSIOLOGY

THEORY

1. Introduction

- Definition and scope of Anatomy and Physiology
- Anatomical terms, planes, positions, and movements
- Levels of structural organization of the human body
- Overview of cells and tissues (epithelial, connective, muscular, nervous)

2. Skeletal System

- Structure and functions of bones
- Classification of bones and joints
- Axial and appendicular skeleton
- Major bones of the body
- Types of joints and movements
- Disorders: arthritis, osteoporosis, fractures

3. Muscular System

- Types of muscles (skeletal, smooth, cardiac)
- Structure and functions of skeletal muscle
- Muscle contraction (sliding filament theory in brief)
- Major muscles of the body
- Disorders: myopathy, muscular dystrophy, cramps

4. Circulatory System

- Structure and functions of the heart
- Blood circulation: systemic, pulmonary, portal circulation
- Structure and function of blood vessels (arteries, veins, capillaries)
- Blood composition, functions, blood groups, coagulation



- Lymphatic system: lymph nodes, spleen, thymus, tonsils
- Disorders: hypertension, anemia, heart failure

5. Respiratory System

- Organs of respiration (nose, pharynx, larynx, trachea, lungs)
- Mechanism of breathing and gas exchange
- Control of respiration
- Disorders: asthma, pneumonia, tuberculosis, COPD

6. Digestive System

- Structure and functions of mouth, pharynx, esophagus, stomach, intestines, liver, pancreas, gallbladder
- Digestion and absorption of food
- Metabolism (overview)
- Disorders: ulcer, hepatitis, cirrhosis, constipation

7. Excretory System (Important for Dialysis Technician)

- Structure and functions of kidney, ureter, urinary bladder, urethra
- Nephron structure and urine formation (filtration, reabsorption, secretion)
- Water and electrolyte balance
- Acid-base balance
- Disorders: renal failure, kidney stones, UTI

8. Nervous System

- Structure and function of neuron
- Central nervous system: brain and spinal cord
- Peripheral nervous system: cranial and spinal nerves
- Autonomic nervous system: sympathetic and parasympathetic
- Reflex action and reflex arc
- Disorders: epilepsy, stroke, neuropathy

9. Endocrine System

- Endocrine glands: pituitary, thyroid, parathyroid, adrenal, pancreas, gonads
- Hormones and their functions
- Disorders: diabetes mellitus, hypothyroidism, hyperthyroidism, Addison's disease

10. Reproductive System

- Male reproductive organs and functions
- Female reproductive organs and functions
- Menstrual cycle, fertilization, pregnancy (basic)
- Disorders: infertility, PCOD, prostate enlargement



11. Integumentary System

- Structure of skin, hair, nails
- Functions of skin
- Disorders: dermatitis, skin infections, burns

12. Special Senses

- Structure and function of eye, ear, nose, tongue, skin receptors
- Vision, hearing, taste, smell, touch
- Disorders: cataract, glaucoma, deafness

PRACTICAL

➤ General Practical Skills

- Familiarization with laboratory instruments (microscope, slides, charts, models).
- Handling and preparation of biological specimens.
- Safety measures in anatomy & physiology laboratory.

➤ Cell & Tissue Study

- Microscopic observation of:
 - Epithelial tissues (squamous, columnar, ciliated, stratified).
 - Connective tissues (areolar, adipose, cartilage, bone).
 - Muscle tissues (skeletal, smooth, cardiac).
 - Nervous tissue (neuron).
- Drawing and labeling observed structures.

➤ Skeletal System

- Study of human skeleton model.
- Identification of major bones (skull, vertebrae, ribs, sternum, pelvic bone, long bones).
- Demonstration of types of joints (ball and socket, hinge, pivot, etc.).

➤ Muscular System

- Identification of major muscles on charts/models.
- Demonstration of muscle movements (flexion, extension, abduction, rotation).
- Palpation of selected superficial muscles.

➤ Circulatory System

- Demonstration of heart models and blood vessels.
- Study of systemic, pulmonary, and portal circulation using charts.
- Measurement of **pulse rate** in radial artery.
- Measurement of **blood pressure** using sphygmomanometer.



- Estimation of hemoglobin, blood grouping & cross matching (demonstration/observation).
- **Respiratory System**
 - Identification of organs on models/charts (lungs, trachea, diaphragm).
 - Demonstration of mechanism of breathing using a bell-jar/lung model.
 - Measurement of respiratory rate.
 - Peak expiratory flow rate (PEFR) demonstration.
- **Digestive System**
 - Identification of digestive organs on models/charts.
 - Observation of permanent slides of stomach, intestine, liver, pancreas.
 - Demonstration of digestion of starch by salivary amylase (simple experiment).
- **Excretory System (Most Relevant for Dialysis Technician)**
 - Identification of kidney, ureter, urinary bladder on models/charts.
 - Study of nephron structure (microscopic slide/model).
 - Urine analysis (normal vs abnormal):
 - Physical examination (color, volume, odor, pH, specific gravity).
 - Chemical tests for sugar, protein, ketone bodies (demonstration).
- **Nervous System**
 - Study of brain and spinal cord using models/charts.
 - Identification of parts of brain: cerebrum, cerebellum, medulla, midbrain.
 - Demonstration of reflex action (knee-jerk reflex).
 - Study of cranial nerves (charts/models).
- **Endocrine System**
 - Demonstration of endocrine glands on models/charts.
 - Identification of thyroid, pituitary, adrenal, pancreas (islets of Langerhans).
- **Reproductive System**
 - Identification of male & female reproductive organs using charts/models.
 - Study of ovary & testis under microscope.
- **Special Senses**
 - Demonstration of structure of eye & ear (charts/models).
 - Testing of visual acuity (Snellen's chart).
 - Color vision test (Ishihara chart).
 - Hearing tests (tuning fork tests – Rinne's & Weber's, demonstration).
 - Taste testing (basic taste sensations).



➤ **Integumentary System**

- Study of structure of skin with charts/slides.
- Identification of sweat glands, sebaceous glands, and hair follicles.

BASICS OF DIALYSIS TECHNICS

THEORY

1. Introduction to Dialysis

- Definition and scope of dialysis.
- History and evolution of dialysis.
- Basic principles of dialysis (diffusion, osmosis, ultrafiltration).
- Indications for dialysis (acute and chronic kidney failure).
- Types of dialysis (hemodialysis, peritoneal dialysis, hemofiltration).

2. Anatomy & Physiology Related to Dialysis

- Structure and function of kidney.
- Nephron and mechanism of urine formation.
- Renal function tests (serum creatinine, BUN, electrolytes).
- Fluid and electrolyte balance.
- Acid-base balance in the body.

3. Dialysis Membranes and Fluids

- Dialysis membranes: types (cellulose, synthetic), properties.
- Dialysate fluid: composition, preparation, and safety.
- Principles of solute clearance.
- Buffer systems in dialysis (bicarbonate, acetate).

4. Hemodialysis – Basics

- Vascular access: arteriovenous fistula, graft, central venous catheter.
- Hemodialysis machine – basic components and functions.
- Dialyzer (artificial kidney): structure, types (hollow fiber, flat plate).
- Anticoagulation in dialysis (heparin, citrate).
- Basic dialysis procedure steps (initiation, monitoring, termination).

5. Peritoneal Dialysis – Basics

- Peritoneal membrane as a natural dialyzer.
- Types of peritoneal dialysis: CAPD, APD.
- Catheter insertion and care.
- Advantages, disadvantages, and complications.



6. Patient Preparation for Dialysis

- Pre-dialysis patient assessment (vitals, weight, lab values).
- Infection control and aseptic techniques.
- Patient counseling and psychological support.
- Nutrition and fluid restrictions for dialysis patients.

7. Complications and Management (Introductory)

- Common complications during hemodialysis:
 - Hypotension
 - Cramps
 - Headache
 - Nausea & vomiting
 - Air embolism
- Complications of peritoneal dialysis: peritonitis, catheter infection, hernia.
- Basic emergency management protocols.

8. Dialysis Unit Setup

- Layout and environment of dialysis unit.
- Disinfection and sterilization of dialysis equipment.
- Water treatment system in dialysis unit (importance, basics).
- Safety measures for patients and staff.

9. Ethical and Professional Aspects

- Role and responsibilities of dialysis technician.
- Patient rights, confidentiality, and consent.
- Professional behavior and communication with patients.
- Ethical issues in long-term dialysis care.

PRACTICAL

➤ Introduction & Orientation

- Familiarization with dialysis unit layout and equipment.
- Identification of parts of hemodialysis machine, dialyzer, bloodlines.
- Demonstration of peritoneal dialysis (PD) setup and catheter.
- Safety protocols and infection control practices in dialysis unit.

➤ Vascular Access

- Identification of vascular access types (AV fistula, graft, central venous catheter).
- Demonstration of access site care and aseptic precautions.
- Observation of cannulation procedure (done by nurse/doctor).
- Hands-on training with models for AV fistula cannulation (where available).



➤ **Dialysis Machine Handling (Basic)**

- Parts of dialysis machine: blood pump, dialysate pump, monitor, alarms.
- Switching on/off and priming the dialysis machine (demonstration).
- Setting dialysate flow and blood flow rates.
- Checking and handling alarms (air detector, pressure monitors, temperature).

➤ **Dialyzer & Dialysate Preparation**

- Identification of types of dialyzers (hollow fiber, flat plate).
- Demonstration of dialyzer reprocessing (cleaning, rinsing, sterilization – introduction only).
- Preparation of dialysate fluid and checking composition.
- Demonstration of bicarbonate and acetate buffer system.

➤ **Hemodialysis Procedure (Demonstration & Practice on Models)**

- Pre-dialysis preparation: checking vitals, weight, and lab values.
- Priming of extracorporeal circuit (bloodlines & dialyzer).
- Connecting patient to machine (demonstration).
- Monitoring patient during dialysis: vitals, blood pressure, symptoms.
- Termination of dialysis: returning blood, disconnecting patient.

➤ **Peritoneal Dialysis (PD)**

- Identification of PD catheter and accessories.
- Demonstration of CAPD (Continuous Ambulatory Peritoneal Dialysis) exchange procedure.
- Maintaining aseptic technique during PD.
- Observation of APD (Automated Peritoneal Dialysis).

➤ **Complications & Management (Introductory Practical)**

- Recognition of common hemodialysis complications:
 - Hypotension
 - Muscle cramps
 - Nausea/vomiting
 - Air embolism (demonstration with models/charts)
- Observation of management steps by dialysis staff.
- Demonstration of emergency protocols: CPR basics, emergency trolley setup.

➤ **Water Treatment System (Introductory)**

- Introduction to water purification system in dialysis (RO plant, filters).
- Demonstration of water quality testing (chlorine, hardness, conductivity – observation).
- Importance of safe water for dialysis.



➤ **Infection Control & Waste Disposal**

- Hand hygiene techniques (WHO method).
- Use of gloves, masks, gowns during dialysis procedures.
- Biomedical waste segregation and disposal in dialysis unit.
- Surface and equipment disinfection procedures.

➤ **Patient Care & Communication**

- Pre- and post-dialysis patient assessment (weight, vitals, symptoms).
- Counseling of patient regarding fluid restriction and diet (demonstration).
- Recording patient data in dialysis register/software.
- Maintaining confidentiality and ethical practices.

BIOCHEMISTRY

THEORY

1. Introduction to Biochemistry

- Definition, scope, and importance of biochemistry in healthcare.
- Structure and function of biomolecules.
- pH, buffer systems, and their role in the body.
- Clinical significance of biochemistry in renal disorders.

2. Carbohydrates

- Classification, structure, and functions of carbohydrates.
- Digestion and absorption of carbohydrates.
- Glycolysis, gluconeogenesis, glycogen metabolism (overview).
- Diabetes mellitus – biochemical basis and monitoring.
- Blood glucose estimation and significance.

3. Proteins & Amino Acids

- Structure, types, and functions of proteins.
- Essential and non-essential amino acids.
- Protein digestion and metabolism (overview).
- Plasma proteins and their role in health.
- Disorders: proteinuria, hypoalbuminemia (in renal disease).
- Clinical estimation of serum proteins and albumin.

4. Lipids

- Classification and functions of lipids.



- Digestion, absorption, and transport of lipids.
- Cholesterol and lipoproteins (HDL, LDL, VLDL).
- Role of lipids in atherosclerosis and cardiovascular disease.
- Lipid abnormalities in kidney patients.

5. Enzymes

- Definition, properties, and classification of enzymes.
- Factors affecting enzyme activity (temperature, pH, inhibitors).
- Diagnostic importance of enzymes (urease, creatine kinase, LDH, ALT, AST).
- Enzyme assays (principles).

6. Nucleic Acids

- Structure of DNA and RNA.
- Functions of nucleic acids.
- Basics of replication, transcription, translation (overview).
- Clinical importance: genetic disorders, cancers.

7. Vitamins & Minerals

- Classification: water-soluble and fat-soluble vitamins.
- Functions and deficiency disorders of vitamins (A, D, E, K, B-complex, C).
- Major minerals: calcium, sodium, potassium, magnesium, chloride, phosphorus.
- Trace elements: iron, zinc, iodine.
- Importance of electrolytes in dialysis patients.

8. Water & Electrolyte Balance

- Body water distribution and osmotic pressure.
- Mechanisms of fluid balance.
- Electrolyte regulation: sodium, potassium, calcium, bicarbonate.
- Acid-base balance and buffer systems in the body.
- Biochemical changes in renal failure and dialysis.

9. Renal Biochemistry (Most Relevant)

- Kidney function and biochemical aspects of urine formation.
- Non-protein nitrogenous substances: urea, creatinine, uric acid.
- Blood Urea Nitrogen (BUN), serum creatinine – importance in dialysis.
- Urine analysis: normal vs abnormal constituents.
- Biochemical markers of kidney disease.

10. Clinical Biochemistry Applications

- Liver function tests (bilirubin, liver enzymes, proteins).
- Blood lipid profile.
- Blood glucose and HbA1c.



- Biochemical investigations in chronic kidney disease (CKD).
- Dialysis adequacy assessment (Kt/V, URR – introduction).

PRACTICAL

➤ **Laboratory Orientation & Safety**

- Introduction to biochemistry laboratory equipment (pipettes, centrifuge, colorimeter, spectrophotometer, flame photometer).
- Preparation of reagents, buffers, and solutions.
- Units of measurement and normal laboratory values.
- Laboratory safety rules and biomedical waste disposal.

➤ **Carbohydrate Analysis**

- Qualitative tests for carbohydrates: Benedict's, Fehling's, Molisch's, Barfoed's, Iodine test.
- Quantitative estimation of blood glucose:
 - Glucose oxidase/peroxidase method (GOD-POD).
 - Folin-Wu / O-Toluidine method (demonstration/observation).
- Urine sugar testing (Benedict's test, dipstick method).

➤ **Protein Analysis**

- Qualitative tests for proteins: Biuret, Xanthoproteic, Millon's, Ninhydrin.
- Quantitative estimation of serum proteins (Biuret method).
- Estimation of serum albumin and A/G ratio.
- Urine protein test (heat coagulation, sulfosalicylic acid test).

➤ **Lipid Analysis**

- Tests for lipids: Sudan III staining, saponification, emulsification.
- Estimation of serum cholesterol (enzymatic method).
- Observation of lipid profile (HDL, LDL, triglycerides).

➤ **Enzyme Activity**

- Demonstration of enzyme activity (e.g., effect of temperature and pH on salivary amylase).
- Estimation of serum enzymes (SGPT, SGOT, alkaline phosphatase – demonstration/observation).

➤ **Renal Function Tests (Most Relevant for Dialysis Technician)**

- Estimation of blood urea (Diacetyl monoxime / Urease method).
- Estimation of serum creatinine (Jaffe's method).
- Estimation of uric acid (Caraway method / enzymatic method).
- Interpretation of BUN and creatinine clearance (theory + calculation practice).



➤ **Electrolyte & Acid-Base Balance**

- Demonstration of serum sodium, potassium, chloride estimation (flame photometer/ion-selective electrode).
- Determination of serum calcium and phosphorus (colorimetric methods).
- pH measurement of urine/blood samples.
- Buffer preparation and demonstration of buffering action.

➤ **Urine Analysis (Normal & Abnormal)**

- Physical examination: color, volume, odor, pH, specific gravity.
- Chemical tests:
 - Sugar, proteins, ketone bodies, bile salts, bile pigments, blood.
- Microscopic examination of urinary deposits (RBCs, WBCs, casts, crystals).

➤ **Clinical Case-Oriented Practicals**

- Interpretation of biochemical reports of kidney disease patients.
- Correlation of lab findings with dialysis requirement.
- Case discussions: CKD, AKI, diabetic nephropathy.

PATHOLOGY

THEORY

1. Introduction to Pathology

- Definition, scope, and branches of pathology (general, systemic, clinical).
- Basic terms: lesion, necrosis, degeneration, inflammation, neoplasia.
- Methods of studying pathology: biopsy, cytology, autopsy, histopathology.

2. Cell Injury & Adaptation

- Causes of cell injury (hypoxia, toxins, infections).
- Types of cell injury: reversible and irreversible.
- Cellular adaptation: hypertrophy, hyperplasia, atrophy, metaplasia.
- Necrosis and apoptosis – types and significance.

3. Inflammation & Repair

- Acute and chronic inflammation – causes, features, outcomes.
- Cells and chemical mediators of inflammation.
- Healing and repair: regeneration, fibrosis, scar formation.
- Wound healing and factors affecting healing.



4. Disorders of Circulation

- Edema – types, causes, and relevance in renal disease.
- Thrombosis, embolism, infarction.
- Shock – types and pathophysiology.
- Hemorrhage and hemostasis.

5. Immunopathology

- Basic concepts of immunity.
- Hypersensitivity reactions (Types I–IV).
- Autoimmune diseases (SLE, rheumatoid arthritis).
- Transplant rejection (basic).
- Relevance of immune reactions in dialysis and renal transplantation.

6. Hematology

- Composition and functions of blood.
- Anemia – classification, causes, features (iron deficiency, hemolytic, megaloblastic).
- Leukemia – basic types and features.
- Bleeding disorders (hemophilia, thrombocytopenia, DIC).
- Hematological changes in renal failure.

7. Systemic Pathology – Kidney & Urinary Tract (Most Relevant)

- Normal structure and function of kidney.
- Acute kidney injury (AKI) – causes, pathology.
- Chronic kidney disease (CKD) – stages, pathology, complications.
- Glomerular diseases (glomerulonephritis, nephrotic syndrome).
- Tubular and interstitial diseases (pyelonephritis).
- Polycystic kidney disease.
- Renal tumors (renal cell carcinoma, Wilms' tumor).
- Urinary tract infections (UTI).
- Obstructive uropathy, renal stones.

8. Systemic Pathology – Other Organs

(Brief overview, to understand comorbidities in dialysis patients)

- Cardiovascular system: atherosclerosis, myocardial infarction, hypertension.
- Respiratory system: pneumonia, tuberculosis.
- Liver: hepatitis, cirrhosis.
- Endocrine system: diabetes mellitus, thyroid disorders.

9. Clinical Pathology

- Collection and preservation of specimens: blood, urine, sputum.



- Urine examination (physical, chemical, microscopic).
- Hematology tests: Hb, PCV, ESR, TLC, DLC, blood grouping.
- Coagulation profile (PT, aPTT, bleeding time, clotting time – overview).
- Serological tests: Widal, HIV, HBsAg, VDRL (introduction).
- Biopsy and cytology – basics.

10. Pathology Related to Dialysis

- Complications of long-term dialysis (anemia, infections, amyloidosis).
- Pathology of renal osteodystrophy.
- Dialyzer-related reactions.
- Blood-borne infections in dialysis unit (Hepatitis B, Hepatitis C, HIV).

PRACTICAL

➤ Laboratory Orientation & Safety

- Familiarization with pathology laboratory equipment (microscope, centrifuge, hemocytometer, slides, stains).
- Collection, labeling, and preservation of clinical specimens (blood, urine, sputum).
- Universal precautions and biomedical waste disposal.

➤ Hematology Practicals

- Estimation of Hemoglobin (Sahli's / Cyanmethemoglobin method).
- Determination of Packed Cell Volume (PCV).
- Estimation of Erythrocyte Sedimentation Rate (ESR).
- Total Leukocyte Count (TLC) and Differential Leukocyte Count (DLC) using blood smear.
- Platelet count (manual method).
- Coagulation tests (bleeding time, clotting time – demonstration).
- Peripheral blood smear preparation and staining (Leishman's/Giemsa) with identification of normal RBCs, WBCs, and platelets.

➤ Urine Examination (Highly Relevant for Dialysis)

- Physical examination: color, odor, volume, pH, specific gravity.
- Chemical examination:
 - Albumin (heat test, sulfosalicylic acid test).
 - Sugar (Benedict's test, dipstick method).
 - Ketone bodies, bile salts, bile pigments, blood.
- Microscopic examination of urinary sediment: RBCs, WBCs, pus cells, casts, crystals, epithelial cells.

➤ Clinical Pathology Practicals



- Collection and preservation of blood, urine, sputum samples.
- Demonstration of bone marrow smear preparation (observation only).
- Examination of body fluids (CSF, pleural fluid – demonstration).
- Semen analysis (basic introduction).

➤ **Histopathology & Cytology (Demonstration / Observation)**

- Fixation and processing of tissues.
- Embedding, section cutting, and staining (H&E).
- Observation of prepared slides:
 - Kidney (normal, glomerulonephritis, chronic kidney disease).
 - Liver (hepatitis, cirrhosis).
 - Tumors (benign vs malignant features).
- Demonstration of fine needle aspiration cytology (FNAC).

➤ **Blood Grouping & Cross Matching**

- ABO and Rh blood grouping (slide and tube method).
- Cross-matching principle and demonstration (important for dialysis transfusion cases).

➤ **Infection Screening (Relevant for Dialysis Unit)**

- Rapid tests for HIV, HBsAg, HCV (demonstration).
- Screening methods for tuberculosis (sputum smear AFB – demonstration).
- Sterility testing in dialysis unit (demonstration).

➤ **Case Studies & Report Interpretation**

- Interpretation of complete blood count (CBC) reports.
- Interpretation of urine examination reports.
- Correlation of lab findings with kidney disease and dialysis requirement.
- Discussion of pathology case sheets of CKD, anemia, UTI, hepatitis in dialysis patients.