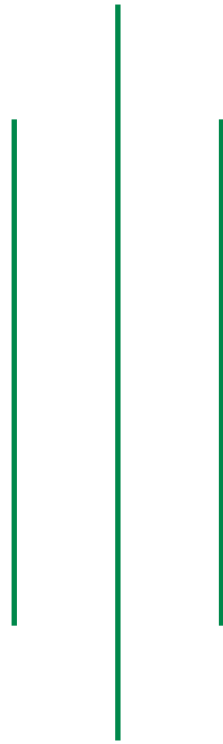


Syllabus for Licensing Examination of B.Sc. Renal Dialysis Technology 2021



Nepal Health Professional Council
Bansbari, Kathmandu

Table of Content

S.N	Topics	Marks percentage
1	Basic and Applied Anatomy and Physiology	15 %
2	Basic and Applied Pathology, Microbiology, Pharmacology & Biochemistry	10 %
3	Concepts of Renal Diseases and Renal Transplant	10 %
4	Basics of Renal Dialysis Technology	20 %
5	Applied Dialysis Technology a) Hemodialysis b) Peritoneal dialysis c) Continuous Renal Replacement Therapy (CRRT) d) Water treatment e) Dialysis access f) Plasmapheresis g) Nutrition	15% 5% 5% 5% 5% 5% 5%
	Total	100 %

1) Basic and Applied Anatomy and Physiology

Basic anatomy and physiology

- Related to Kidney, Bladder, Ureter, Urethra, Prostate- including embryology, histology, blood supply, and gross anatomy.

Applied physiology

- Mechanism of Urine Formation, estimation of GFR.
- Acid-Base and electrolyte balance: Basic Principles & Common Abnormalities like Hypokalemia, Hyponatremia, Hyperkalemia, Hyponatremia, Hypocalcemia, Hypercalcemia, pH, Etc.

2) Basic and applied pathology, microbiology, pharmacology and biochemistry

Basic and applied pathology

- General and clinical pathology- Cell injury, acute and chronic inflammation, hemodynamic disorders, shock, necrosis, embolism, immune system, autoimmune diseases, neoplasia, congenital anomalies of urinary tract, glomerular diseases, tubule-interstitial diseases, renal vascular diseases, pathology of urinary tract infection, pyelonephritis, mechanism of end stage renal disease.
- Hematology and Blood Banking
- General Pathology- cell injury, inflammation, hemodynamic disorder, immune system, Neoplasia, congenital anomaly of renal system.

Microbiology

- Introduction, growth and nutrition, disinfection, biomedical waste management, immunology, Infection, systemic bacteriology, parasitology, virology, Mycology

Pharmacology

- Diuretics, antihypertensives, vasopressor, and inotropes, colloids and crystalloids, erythropoietin, phosphate binders, iron supplements, anticoagulants, protamine sulphate, antibiotics, vaccines, peritoneal dialysis solutions, immunosuppressive drugs, hemodialysis solutions, CRRT solutions

Biochemistry

- Definition, classification and functions of enzymes, carbohydrates, lipids phospholipids and amino acids.
 - Metabolism of carbohydrate, proteins and lipids, Glycogen, Vitamins, Mineral
 - Renal Function Tests
 - Name the different tests to assess the kidney functions
 - Explain Creatinine clearance & Inulin clearance
 - Radioactive Isotopes
 - Definition, clinical applications
 - Biological effects of radiations
 - Clinical Biochemistry: Definitions of acid, base, pH and pKa , Buffer systems, Henderson Hassel Balch equation,
 - Acidosis & Alkalosis (Definition, Classification, causes and biochemical findings
 - Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H₂SO₄, H₃PO₄, CH₃COOH etc.,)
 - Preparation of percent solutions - w/w, v/v w/v (solids, liquids and acids),

Conversion of a percent solution into a molar solution

3) Concepts of Renal Diseases and Renal Transplant

- Acute renal failure
- Nephrotic syndrome - primary & secondary
- Nephritic syndrome
- UTI- urinary tract infections
- Asymptomatic urinary abnormalities
- Chronic renal failure causes, stages, diagnosis and management
- Renal stone diseases
- Obstructive uropathies
- Congenital & inherited renal diseases tumors of kidney Pregnancy associated renal diseases
- Renal vascular disorders & hypertension associated renal diseases
- Renal replacements therapies
- Renal nutrition: Pre- dialysis stage (Stage 1-4), hemodialysis, peritoneal Dialysis and post-transplant.

4) Basic of Renal Dialysis Technology

- Checking vitals- Blood pressure, Heart rate, Respiratory rate and temperature
- Basic science related to Dialysis
- Indications for Dialysis
- Types of Dialysis
- Vascular access
- Dialyzer-types, membrane, surface area, clearance and Kuf
- Dialysis solutions compositions
- Pre hemodialysis assessments
- Monitoring during Dialysis
- Post dialysis assessments
- Complications during Dialysis
- Hemodialysis machines preparation and settings
- Hemodialysis machine alarms during Dialysis and troubleshooting
- Anticoagulation
- Dialyzer reuse
- Water treatment system - basics
- Peritoneal Dialysis- Physiology of Peritoneal Dialysis and apparatus for peritoneal Dialysis
- BCLS and Crash-cart management
- Equipment used in Dialysis and its monitoring and safety check: Hemodialysis machine, dialyzer re-processor, CRRT machines, Cardiac monitors, Defibrillator, ECG machines, BP apparatus, USG machines, Acid Bicarbonate mixing system, Water treatment system.
- Infection control practices and universal precautions
- Hand wash, Waste management
- Needlestick management and prevention
- Personal protective equipment and appropriate usage
- Cleaning and disinfection of dialysis machines
- Managing patients with HIV HBsAg and HCV
- Vascular access- infection prevention

- Blood spill management.
- Hazardous material storage and spill management

5) Applied Dialysis Technology

A. Hemodialysis

- Theory of hemodialysis - diffusion, osmosis, ultrafiltration & solvent drag
- AV access monitoring and complications
- Hemodialysis apparatus
- Blood circuit, dialysis fluid circuit, Conductivity, Temperature, Bypass valve, Blood leak detector, Dialysate outflow pressure monitor, Ultrafiltration control, Advanced control options
- Adjustable bicarbonate,
- Variable sodium.
- Programmable ultrafiltration
- Monitoring UV absorbance of spent dialysate (online Kt/V)
- Online sodium clearance monitors.
- Blood temperature control module.
- Modules to measure access recirculation or access blood flow
- Blood volume monitors.
- Single blood pathway ("single-needle") devices
- Dialyzers and Membranes
- Dialysis solutions
 - Fluid quality standards
 - Ultrapure dialysis solutions
 - Different types of mixing ratios
 - Content of dialysis solution
 - Bicarbonate concentrates mixing and distribution systems.
 - Dialysis solution preparation
- Dual-concentrate system for bicarbonate-based solutions.
- Dry concentrates
- Bicarbonate.
- Acid (citric acid or sodium diacetate)
- Final dialysis solution composition
- Disinfection of dialysis machines
- Acute hemodialysis prescriptions & chronic hemodialysis prescriptions
- Adjustment of the dialysis solution levels of bicarbonate, sodium, calcium, magnesium, potassium, phosphorus.
- Ultrafiltration guidelines
- Dialysis solution flow rate (Qd)
- Dialysis solution temperature
- Blood flow rate (Qb)
- Clearance and adequacy
- Complications during hemodialysis
- Biochemical investigations for dialysis patients and its significance
- Urea Kinetic modelling
- Mechanisms of solute transport
- Solute removal from the perspective of the dialyzer
- Concept of clearance

- Urea reduction ration (RR), spKt/V, eKt/V
- Solute removal from the patient perspective
- Access recirculation
- Cardiopulmonary recirculation
- Urea nitrogen generation rate (g) and the nPNA
- Residual renal function
- Anticoagulation
- Dialyzer reuse
- Withdrawal of dialysis criteria
- Acute dialysis
- Chronic dialysis

B. Peritoneal dialysis

- Physiology of peritoneal dialysis
- Peritoneal Anatomy and physiology.
- Models of peritoneal transport
- Clinical assessment of and implications of peritoneal transport
 - including Peritoneal equilibration test (PET) and Classification
- Peritoneal clearance
- Protein losses
- Residual renal function
- Apparatus for peritoneal dialysis
- Dialysis solution
- Non-glucose solutions
- Transfer set and exchange procedure
- Various connectors for PD
- Automated peritoneal dialysis
- Tidal peritoneal dialysis (TPD)
- APD with day time exchanges
- Peritoneal dialysis catheter, placement and care
- Acute and chronic catheters
- Catheter selection
- Catheter placement procedures
- Special access procedures
- Extended catheters
- Catheter embedding procedure
- Catheter break-in procedures
- Acute complications of catheters
- Complications of chronic peritoneal catheters
- Catheter infection and management
- Care of the chronic peritoneal catheters
- Catheter removal and secondary embedding
- Peritoneal dialysis for the treatment of acute kidney injury
- Indications
- Technical aspects
- Advantages and disadvantages of peritoneal dialysis in acute kidney injury (AKI)
- Complications

- Adequacy of peritoneal dialysis and chronic PD prescription
- Volume status and fluid overload in Peritoneal dialysis
- Complications of PD
- Peritonitis- pathogenesis, diagnosis, treatment,
- Exit -site and tunnel infection pathogenesis, diagnosis, treatment
- Other complications- Hernia, leaks and encapsulating peritoneal sclerosis in Peritoneal dialysis (mechanical complications), Respiratory complications, Genital Edema, Encapsulating peritoneal sclerosis
- Metabolic complications- Hyperglycaemia, Weight gain, Peritoneal protein loss, Lipid abnormalities, Hypokalemia/ hyperkalemia, Metabolic acidosis, Hypo/Hypernatremia

C. CRRT

- Types of CRRT
- Clinical indications for CRRT versus intermittent renal replacement therapy
- Differences among C-HD, C-HF, and C-HDF in the clearance of small and large molecular-weight solutes
- Filtration fraction
- CRRT filters
- Dialysates and replacement solutions
- Methods of preparing bicarbonate-based CRRT solutions when pre-packaged solutions are not available
- Prescribing and delivering CRRT
- Regional citrate anticoagulation for continuous RRT
- Isolated ultrafiltration and slow continuous ultrafiltration (SCUF)
- Molecular Adsorbent Recirculating System (MARS)

D. Water treatment

- AAMI and EPA maximum allowable levels of contaminants in water
- Signs and symptoms and possible water contaminant
- Feed Water Components
- Back-flow preventer, temperature blending valve, booster pump
- Pre-treatment Components
- Chemical injection systems
- Sediment filters.
- Water softener
- Carbon adsorption
- Reverse Osmosis Systems
- Cartridge prefilter RO System
- RO pump and motor assembly
- RO membranes
- Post-treatment Components
- Deionization.
- Ultraviolet irradiator (UV).
- Submicron and ultrafiltration (UF)
- Distribution System
- Water storage.
- Water distribution piping systems.
- Alternative Disinfection of Water Systems
- Ozone disinfection.

- Hot water disinfection systems
- Bacteria and endotoxin bacteria testing of product water
- Bacteria assaying technique.
- Endotoxin testing of product water
- Bacteriology of Dialysate
- Conventional dialysate
- Ultrapure dialysate.
- Dialysate for infusion (Water for online HDF)

E. Dialysis access

✿ Arteriovenous fistula

- Types of vascular access
- Vessel preservation
- Preoperative evaluation
- Physical examination
- Imaging studies
- Allen Test
- Venography
- Possible locations for upper extremity AV fistulas
- Perioperative care and fistula maturation
- Rule of sixes
- Details of fistula maturation
- Initial trial cannulation of a new AV fistula
- Initial cannulation procedure

✿ Arteriovenous grafts

- Potential AV graft locations
- Common locations
- Uncommon locations
- Postoperative care
- Maturation
- Physical examination of AV fistulas and grafts
- Inspection
- Palpation and
- Auscultation
- Pulse
- Thrill
- Auscultation
- Pulse augmentation and arm elevation tests

✿ General issues relating to cannulation of either AV fistulas or grafts

- Skin preparation
- Anesthesia
- Use of tourniquets for AV fistulas.
- Needle size
- Needle position, spacing, and orientation
- Risk of inflow/outflow needle reversal

- Buttonhole cannulation and rope ladder
- Preventing and dealing with infiltration
- Hemostasis post-dialysis

✿ **AV access monitoring and complications**

- Stenosis
- Thrombosis
- Ischemia in a limb bearing AV access
- Pseudo-aneurysm
- Congestive heart failure

✿ **Veno-venous access**

- Catheter types and design
- Insertion location

✿ **Selected Factors favoring different temporary (Non tunneled) hemodialysis catheter insertion sites**

✿ **Cuffed catheter advantages and types**

✿ **Insertion-related complications**

✿ **Care and use of venous catheters**

✿ **Risk of air embolism on the removal of dialysis catheters from the neck.**

✿ **Catheter locks**

✿ **Prophylactic antibiotics**

✿ **Nasal decolonization**

F. Venous catheter infections and other Complications

- Infections
- Poor catheter flow (Catheter dysfunction)
- Thrombosis
- Central venous stenosis
- Catheter adhesion
- Hemodialysis apparatus

G. Plasmapheresis

- Indications
- Pharmacokinetics of immunoglobulin (IG)
- The macromolecule reduction ratio
- Membrane plasma separation and centrifugal aphaeresis
 - Comparison of membrane plasma separation and centrifugal aphaeresis
 - Plasma volume calculation
 - Complications
 - Replacement solutions
 - The selective aphaeresis procedure
 - LDL aphaeresis.

- Immunoabsorption columns.
- Double filtration plasmapheresis (DFPP)
- Cryofiltration.

H. Nutrition

- Introduction to the science of nutrition
- Definition
- Food pattern and its relation to health
- Factors influencing food habits, selection and foodstuffs
- Superstitions, culture, religion, income, the composition of family, age, occupation, special group
- Food selection, storage & preservation
- Prevention of food adulteration
- Classification of nutrients
- Macronutrients and micronutrients
- Proteins- types, sources, requirements and deficiencies of proteins
- Carbohydrates sources, requirements & deficiency
- Fats- types, sources, requirements and deficiency of fats
- Water- sources of drinking water, requirements, preservation of water
- Minerals - types, sources, requirements deficiencies of minerals
- Vitamins - types, sources, requirements deficiencies of vitamins
- Planning diets
- Need for planning diets
- Concept of a balanced diet
- Food
- Preparation of basic recipes - clear fluids
- Full fluids, vegetable preparation, egg recipes, fish and meat recipes, light puddings
- group & a balanced diet
- Influence of age, sex, occupation & physiological state
- Recommended dietary intake in planning diet
- Steps in planning a balanced diet
- Planning renal diet
- Purpose and methods of cooking
- Effects of heat on the cooking of foods