Bachelors of Dialysis

Therapy Technology - (BDTT)

Syllabus

Year/Semester – I/ I & II

Academic Scheme & Credit Framework

APPROVED SYLLABUS (NCAHP) 2025

Ministry of Health & Family Welfare

Bachelors of Dialysis Therapy Technology - (BDTT) Syllabus

Four -Year Degree Program (Including Internship)

1. Program Duration

Duration of the program is 4 years or 8 semesters (inclusive of one year of internship) with 1545 hours of Lecture & 2115 hours of Practical Training and another 2160 hours dedicated for internship and 180 hours dedicated for Dissertation/Project.

Total number of hours – 6000

Total Credits: 216

Evaluation Scheme DDT												
Semester	Result in Group (RG) #	Credit/ Week				Hours/ Semester			Continuous Internal assessment CIA- Theory / Practical (a)	End Semester		Grand Total
		Lecture	Tutorial/ Clinical Training	Practical/ Research Project	Credits	Lecture	Practical/ Tutorial	Total Hours		Theory (b)	Practical/Viva(c)	Theory: a+(b÷2) =100 Practical: a + c =100
I	A,B,C	17	6	6	29	255	390	645	650	400	150	1000
II	E,F,G,H	19	3	4	26	285	255	540	500	500	250	1000
III	I	16	6	2	24	240	300	540	600	100	100	800
IV	J,K	18	6	4	28	270	360	630	450	700	100	900
V	L,M,N	16	4	6	26	240	360	600	400	400	200	800
VI	O,P	12	8	3	23	180	420	600	350	400	150	700
VII	--	--	24	--	24	--	1080	1080	100	--	--	100
VIII	--	--	24	6	30	--	1260	1260	100	--	100	200
Grand Total		**98**	**81**	**31**	**210**	**1470**	**4425**	**5895**	**3150**	**2500**	**1050**	**5500**

Note:-

 # Results in Group (RG) – For Programs wherein Theory and Practical's (Lab Course) are assessed jointly (RG), the passing minimum for the theory exams and Practical exams have to be obtained separately, in order to be declared passed in the individual courses and thereby earning the credits for both Theory and Practical courses. Reappearance in any one of the components (Theory or Practical) is treated as reappear in both these components (Theory and Practical's).

2. Credit System (As per NCAHP Guidelines)

The credit system shall be adopted to define the instructional workload of a course.

2.1 Definition of Credit

One Credit shall be equivalent to any one of the following instructional components per week:

- One (1) hour of **Lecture**, or
- Two (2) hours of **Practical / Laboratory**, or
- Two (2) hours of **Clinical Training**, or
- Two (2) hours of **Research Project Work.**

3. Semester Duration

Each semester shall consist of fifteen (15) weeks of teaching–learning activities, excluding examinations.

Credit–Hour Equivalence (Per Semester)

Type of Instruction	Credits	Hours per Week	Total Hours per Semester
Lecture	1 Credit	1 Hour	15 Hours
Lecture	3 Credits	3 Hours	45 Hours
Practical / Laboratory	0.5 Credit	2 Hours	15 Hours
Clinical Training	1 Credit	2 Hours	30 Hours
Research Project	1 Credit	2 Hours	30 Hours

4. Credit Nomenclature

Abbreviation	Description
CL	Credit for Lecture
CP	Credit for Practical / Laboratory
L	Lecture Hours per Semester
P	Practical / Laboratory Hours per Semester

5. Sample Credit Allocation Pattern

CL	CP	Lecture Hours (L)	Practical Hours (P)
3	**0.5**	**45**	**15**

Explanation:

- A course with 3 Lecture Credits (CL) shall have 45 lecture hours per semester.
- A course with 0.5 Practical Credit (CP) shall have 15 practical/laboratory hours per semester.

First Semester

Medical terminologies and record keeping (30 Hours)

This course introduces the elements of medical terminology. Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes, and suffixes. Topics include origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study. Spelling is critical and will be counted when grading tests. Topics to be covered under the subject are as follows:

1. Derivation of medical terms. - Origin, uses and purpose of medical terminology,
2. Word roots, prefixes, and suffixes. - Musculo-skeletal system, respiratory system, cardiovascular system, Digestive system, Endocrine system, Central Nervous system, Urinary system, Reproductive system, Organs of special sense and Integumentary system. prefixes and pseudo prefixes used in medical terminology, suffixes and pseudo suffixes used in medical terminology.
3. Conventions for combined morphemes and the formation of plurals.
4. Basic anatomical medical terms.
5. Form medical terms utilizing roots, suffixes, prefixes, and combining roots.
6. Interpret basic medical abbreviations/symbols.
7. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system.
8. Interpret medical orders/reports.
9. Formats and Contents of medical records
10. Data entry and management on electronic health record system.

Professionalism and Values & Indian Constitution (30 Hours)

Part A Professionalism and Values

The course on professionalism will deliver the concept of what it means to be a professional and how a specialized profession is different from a usual vocation. It also explains how relevant professionalism in terms of healthcare system is and how it affects the overall patient environment.

1. Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality
2. Personal values- ethical or moral values
3. Attitude and behavior- professional behavior, treating people equally.
4. Code of conduct, professional accountability and responsibility, misconduct
5. Differences between professions and importance of team efforts.
6. Cultural issues in the healthcare environment

Part B Indian Constitution

The course on Indian Constitution provides understanding of knowledge of the Indian constitution. Familiarize students with the fundamental rights and duties. Understand the importance of constitutional laws. Understand the correlation between Indian constitution, democracy, and society.

1. Meaning of the term 'Constitution'. Making of the Indian Constitution 1946- 1950.
2. The democratic institutions created by the constitution, bicameral system of Legislature at the Centre and in the States.
3. Fundamental rights and duties their content and significance.
4. Directive principles of States, policies need to balance fundamental rights with directive principles.
5. Special rights created in the Constitution for Dalits, backwards, women and children and the religious and linguistic minorities.
6. Doctrine of Separation of Powers, legislative, executive, and judicial and their functioning in India.
7. The Election Commission and State Public Service commissions.
8. Method of amending the Constitution.
9. Enforcing rights through writs.
10. Constitution and sustainable development in India.

Human Anatomy (90 Hours)

1. Introduction: Human body as a whole
    a. Definition of anatomy and its divisions.
    b. Terms of location, positions, and planes.
    c. Cell and its organelles.
    d. Epithelium: definition, classification, describe with examples, function.
    e. Glands: classification, describe serous, mucous & mixed glands with examples.
    f. Basic tissues: classification with examples
2. Locomotion and support
    a. Cartilage: types with example & histology.
    b. Bone: classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, inter-vertebral disc, fontanelles of fetal skull.
    c. Joints: classification of joints with examples, synovial joint (in detail for radiology).
    d. Muscular system: classification of muscular tissue & histology, names of muscles of the body.

3. Cardiovascular system
    a. Heart: size, location, chambers, exterior & interior, blood supply of heart.
    b. Systemic & pulmonary circulation, branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery, peripheral pulse, inferior vena cava, portal vein, porto-systemic anastomosis, great saphenous vein, dural venous sinuses. Lymphatic system: cisterna chyli & thoracic duct, histology of lymphatic tissues, names of regional lymphatics, axillary and inguinal lymph nodes in brief. Anatomy correlated to vascular access to be emphasized.

4. Gastro-intestinal system
    a. Parts of GIT, oral cavity, lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring, esophagus, stomach, small and large intestine, liver, gall bladder, pancreas, radiographs of abdomen.
5. Respiratory system
    a. Parts of RS, nose, nasal cavity, larynx, trachea, lungs, broncho-pulmonary segments, histology of trachea, lung and pleura, names of paranasal air sinuses.
6. Peritoneum
    a. Description in brief.
7. Urinary system
    a. Kidney, ureter, urinary bladder, male and female urethra. Histology of kidney, ureter and urinary bladder.
8. Reproductive system
    a. Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology). Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology). Mammary gland: gross.
9. Endocrine glands
    a. Endocrine glands: pituitary gland, thyroid gland, parathyroid gland, suprarenal glad (gross & histology).
10. Nervous system
    a. Neuron, classification of nervous system, cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology), meninges, ventricles & cerebrospinal fluid, names of basal nuclei, blood supply of brain, cranial nerves.
    b. Sympathetic trunk & names of parasympathetic ganglia.
11. Sensory organs
    a. Skin: histology, appendages of skin.
    b. Eye: parts of eye & lacrimal apparatus. Extra-ocular muscles & nerve supply.
    c. Parts of ear: external, middle and inner ear and contents.
12. Embryology:
    a. Spermatogenesis & oogenesis.
    b. Ovulation, fertilization.
    c. Fetal circulation.
    d. Placenta.

Human Physiology (90 Hours)

1. Blood
    a. Introduction: composition and function of blood.
    b. Red blood cells: erythropoiesis, stages of differentiation, function, count, physiological variation.
    c. Structure, function, concentration, physiological variation, methods of estimation of hemoglobin.
    d. White blood cells: production, function, life span, count, differential count.
    e. Platelets: origin, normal count, morphology functions.
    f. Plasma proteins: production, concentration, types, functions, albumin, globulin, fibrinogen, prothrombin.
    g. Hemostasis: definition, normal hemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.
    h. Blood bank:
    i. Blood groups: ABO system, Rh system.
    j. Blood grouping & typing, cross matching.
    k. Rh system: Rh factor, Rh incompatibility.
    l. Blood transfusion: indication, universal donor and recipient concept.
    m. Selection criteria of a blood donor, transfusion reactions.
    n. Anticoagulants: classification, examples and uses.
    o. Anemias: morphological and etiological classification, effects of anemia on body.
    p. Blood indices: colour index, MCH, MCV, and MCHC.
    q. Erythrocyte sedimentation rate (ESR) and packed cell volume, normal values, definition, determination.
    r. Blood volume: normal value, determination of blood volume and regulation of blood volume.
    s. Body fluid: pH, normal value, regulation and variation.
    t. Lymph: lymphoid tissue formation, circulation, composition and function of lymph
2. Cardiovascular system
    a. Heart: physiological anatomy, nerve supply.
    b. Properties of cardiac muscle, cardiac cycle: systole, diastole. Intra-ventricular pressure curves.
    c. Cardiac output (only definition).
    d. Heart sounds, normal heart sounds, areas of auscultation.
    e. Blood pressure: definition, normal value, clinical measurement of blood pressure.
    f. Physiological variations, regulation of heart rate, cardiac shock, hypotension, hypertension.
    g. Pulse: jugular, radial pulse, triple response.
    h. Heart sounds: normal heart sounds, causes, characteristics and significance, heart rate.
    i. Electrocardiogram (ECG) significance.

3. Digestive System
    a. Physiological anatomy of gastrointestinal tract, functions of digestive system.
    b. Salivary glands: structure and functions, deglutition: stages and regulation.
    c. Stomach: structure and functions.
    d. Gastric secretion: composition function regulation of gastric juice secretion.
    e. Pancreas: structure, function, composition, regulation of pancreatic juice.
    f. Functions of liver. Bile secretion, composition, function, regulation of bile secretion, bilirubin metabolism, types of bilirubin, Vandenberg reaction, jaundice: types, significance.
    g. Functions of gall bladder.
    h. Small intestine: functions, digestion, absorption, movements.
    i. Large intestine: functions, digestion and absorption of carbohydrates, proteins, fats, lipids, defecation
4. Respiratory system
    a. Functions of respiratory system, physiological anatomy of respiratory system, respiratory tract, respiratory muscles.
    b. Respiratory organs: lungs, alveoli, respiratory membrane, stages of respiration.
    c. Mechanism of normal and rigorous respiration, forces opposing and favoring expansion of the lungs. Intra pulmonary pleural pressure, surface tension, recoil tendency of the wall.
    d. Transportation of respiratory gases: transportation of oxygen: direction, pressure gradient, forms of transportation, oxygenation of Hb. Quantity of oxygen transported. Lung volumes and capacities
    e. Regulation of respiration: mechanisms of regulation, nervous and chemical regulation, respiratory center, Hering–Breuer reflex.
    f. Applied physiology and respiration: hypoxia, cyanosis, asphyxia, dyspnea, dysbarism, artificial respiration, and apnea.
5. Endocrine System
    a. Definition, classification of endocrine glands & their hormones, properties of hormones.
    b. Thyroid gland hormone: physiological anatomy, hormone secreted, physiological function, regulation of secretion, disorders: hypo and hyper secretion of hormone.
    c. Adrenal cortex: physiological anatomy of adrenal gland, adrenal cortex, cortical hormones, functions and regulation.
    d. Adrenal medulla: hormones, regulation and secretion. Functions of adrenaline and nor adrenaline.
    e. Pituitary hormones: anterior and posterior pituitary hormones, secretion, function.
    f. Hormones of pancreas.
    g. Insulin: secretion, regulation, function and action.
    h. Diabetes mellitus: regulation of blood glucose level.
    i. Parathyroid gland: function, action, regulation of secretion of parathyroid hormone.
    j. Calcitonin: function and action.

6. Special senses
    a. Vision: structure of eye, function of different parts.
    b. Structure of retina.
    c. Hearing: structure and function of ear, mechanism of hearing.
    d. Taste buds: functions.
    e. Smell: physiology, receptors.
7. Nervous system
    a. Functions of nervous system, neuron: structure, classification and properties.
    b. Neuroglia, nerve fiber, classification, conduction of impulses continuous and saltatory.
    c. Velocity of impulse transmission and factors affecting.
    d. Synapse: structure, types, properties.
    e. Receptors: definition, classification, properties.
    f. Reflex action: unconditioned properties of reflex action. Babinski's sign.
    g. Spinal cord nerve tracts. Ascending tracts, descending tracts.
    h. Pyramidal tracts
        i. Extrapyramidal tracts, functions of medulla, pons, hypothalamic disorders.
        ii. Cerebral cortex lobes and functions, sensory cortex, motor cortex, cerebellum, functions of cerebellum. Basal ganglion: functions. EEG.
        iii. Cerebro Spinal Fluid (CSF): formation, circulation, properties, composition and functions.
        iv. Lumbar puncture.
    i. Autonomic Nervous System:
        i. Sympathetic and parasympathetic distribution and functions and comparison of functions.
8. Excretory System
    a. Functions of kidneys, nephron, vasa recta, cortical and juxtamedullary nephrons, comparison, juxta glomerular apparatus: structure and function. Renal circulation peculiarities.
    b. Mechanism of urine formation: ultrafiltration criteria for filtration GFR, plasma fraction,
    c. GFR, factors effecting GFR. Determination of GFR selective reabsorption –sites of reabsorption, substance reabsorbed, mechanisms of reabsorption of glucose, urea, H+, Cl- amino acids etc. TMG, tubular lead, renal threshold % of reabsorption of different substances, selective secretion.
    d. Properties and composition of normal urine, urine output. Abnormal constituents in urine, mechanism of urine concentration. Counter-current mechanisms: micturition, innervation of bladder, cystometrogram.
    e. Diuretics: water, diuretics, osmotic diuretics, artificial kidney, renal function tests: plasma clearance, actions of ADH, aldosterone and PTH on kidneys.
    f. Renal function tests.

9. Reproductive system
    a. Function of reproductive system, puberty.
    b. Male reproductive system: functions of testes, spermatogenesis: site, stages, factors influencing, semen. Endocrine functions of testes.
    c. Androgens: testosterone structure and functions.
    d. Female reproductive system: ovulation, menstrual cycle: physiological changes during pregnancy, pregnancy test.
    e. Lactation: composition of milk, factors controlling lactation.

10. Muscle nerve physiology
    a. Classification of muscle, structure of skeletal muscle, sarcomere contractile proteins, neuromuscular junction. Transmission across neuromuscular junction. Excitation contraction coupling. Mechanism of muscle contraction muscle tone, fatigue, rigor mortis.

11. Skin
    a. Structure and function, body temperature measurement, physiological variation, regulation of body temperature by physical chemical and nervous mechanisms. Role of hypothalamus, hypothermia and fever.

Biochemistry (90 Hours)

1. Specimen collection:
    a. Pre-analytical variables.
    b. Collection of blood.
    c. Collection of CSF & other fluids.
    d. Urine collection.
    e. Use of preservatives.
    f. Anticoagulants.
2. Introduction to laboratory apparatus
    a. Pipettes: different types (graduated, volumetric, Pasteur, automatic etc.).
    b. Calibration of glass pipettes.
    c. Burettes, beakers, petri dishes, depression plates.
    d. Flasks: different types (volumetric, round bottomed, Erlenmeyer conical etc.).
    e. Funnels: different types (conical, Buchner etc.).
    f. Bottles: reagent bottles – graduated and common, wash bottles – different type specimen bottles
3. Measuring cylinders, porcelain dish
    a. Tubes: test tubes, centrifuge tubes, test tube draining rack.
    b. Tripod stand, wire gauze, Bunsen burner.
    c. Cuvettes, significance of cuvettes in colorimeter, cuvettes for visible and UV range. Cuvette holder racks: bottle, test tube, pipette, desiccator, stop watch, timers, scissors.
    d. Dispensers: reagent and sample.
    e. Maintenance of lab glass ware and apparatus.
    f. Glass and plastic ware in laboratory.

g. Use of glass: significance of boro silicate glass, care and cleaning of glass ware, different cleaning solutions of glass.
h. Care and cleaning of plastic ware, different cleaning solution.

4. Instruments (Theory and demonstration) Diagrams to be drawn
    a. Use, care and maintenance of: water bath, oven & incubators, water distillation plant, water deionizers, refrigerators, cold box, deep freezers, reflux condenser, centrifuge, balances, colorimeter, spectrophotometer, pH meter and electrodes.
    b. Centrifuges: definition, principles, Svedberg unit, centrifugal force, centrifugal field, RPM, conversion of G to RPM and vice versa, different types of centrifuges.
    c. Manual balances: single pan, double pan, triple balance, direct read out electrical balances.
    d. Guideline to be followed and precautions to be taken while weighing. Weighing different types of chemicals, liquids, hygroscopic compounds etc.
    e. Colorimeter, spectrophotometer, pH meter, electrodes, salt bridge solution: principles, parts, types, guidelines to be followed and precautions to be taken while using.

5. Safety of measurements
6. Conventional and SI units
7. Atomic structure
    a. Dalton's theory, properties of electrons, protons, neutrons, and nucleus, Rutherford's model of atomic structure, Bohr's model of atomic structure, orbit and orbital quantum numbers, Heisenberg's uncertainly principle. Electronic configuration, Aufbau principle.
    b. Pauli's exclusion principle, etc.
    c. Valency and bonds: different types of strong and weak bonds in detail with examples.
    d. Theory & Practical for all the following under this section: molecular weight, equivalent weight of elements and compounds, normality, molarity. Preparation of molar solutions (mole/liter solution) e.g.: 1 M NaCl, 0.15 M NaCl, 1 M NaOH, 0.1 M HCl, 0.1 M H2S04 etc.
    e. Preparation of normal solutions. e.g., 1N Na2CO3, O.1N Oxalic acid, 0.1 N HCl, 0.1N H2SO4, 0.66 N H2S04 etc., percent solutions. Preparation of different solutions: v/v w/v (solids, liquids and acids). Conversion of a percent solution into a molar solution.

8. Dilutions
    a. Diluting solutions: e.g. preparation of 0.1 N NaCl from 1 N NaCl & from 2N NaCl etc., preparing working standard from stock standard, body fluid dilutions, reagent dilution techniques, calculating the dilution of a solution, body fluid reagent etc., saturated and supersaturated solutions. Technique for preparation of standard solutions e.g.: glucose, urea, etc., significance of volumetric flask in preparing standard solutions. Volumetric flasks of different sizes, preparation of standard solutions of deliquescent compounds (CaCl2, potassium carbonate, sodium hydroxide etc.). Preparation of standards using conventional and SI unit's acids, bases, salts and indicators.

9. Acids and Bases
    a. Definition, physical and chemical properties with examples. Arrhenius concept of acids and bases, Lowry – Bronsted theory of acids and bases. Classification of acids and bases.
    b. Differences between bases and alkali, acidity and basicity, monoprotic and polyprotic acids and bases. Concepts of acid base reaction, hydrogen ion concentration, ionization of water, buffer, and pH value of a solution.
    c. Preparation of buffer solutions using pH meter. Salts: definition, classification, water of crystallization, definition and different types, deliquescent and hygroscopic salts.

10. Acid- base indicators:
    a. Definition, concept, mechanism of dissociation of an indicator, color change of an indicator in acidic and basic conditions, use of standard buffer solution and indicators for pH determinations, preparation and its application, list of commonly used indicators and their pH range, suitable pH indicators used in different titrations, universal indicators.

11. Quality control
    a. Accuracy, precision. Specificity, sensitivity, limits of error allowable in laboratory, percentage error.
    b. Normal values and Interpretations.

12. Special Investigations
    a. Serum electrophoresis, immunoglobulins, drugs: digitoxin, theophylline, regulation of acid base status, Henderson Hassel Bach equations, buffers of the fluid, pH regulation, disturbance in acid base balance, anion gap, metabolic acidosis, metabolic alkalosis, respiratory acidosis, respiratory alkalosis, basic principles and estimation of blood gases and pH, basic principles and estimation of electrolytes, water balance, sodium regulation, bicarbonate buffers, nutrition, nutritional support with special emphasis on parental nutrition, calorific value, nitrogen balance, respiratory quotient, basal metabolic rate, dietary fibers, nutritional importance of lipids, carbohydrates and proteins, vitamins.

13. Carbohydrate- properties, metabolism of fructose, Glycolysis, TCA cycle, Gluconeogenesis and its biological importance
14. Lipid- properties, metabolism and its biological importance
15. Protein - properties, metabolism, degradation of fatty acids and its biological importance
16. Nucleoproteins- chemistry, structure and function
17. Hemoglobinopathies- structure, properties and abnormal Hb
18. Enzymes- definition, classification, coenzymes, factors affecting their action, enzyme inhibition, enzymes of clinical importance.
19. Vitamins- classification, functions, source, deficiency manifestations and hypervitaminoses.
20. Bioenergetics – Importance of ATP, Mitochondria, biological oxidation, respiratory chain
21. Minerals – Ca2+, phosphorous, Na+ , Cl- , iron, Iodine and copper, water and electrolytes
22. Organ function tests – Liver function test, Renal Function test.

Introduction to Dialysis Therapy (45 Hours)

1. Kidney Diseases Basics AKI & CKD
2. Hemodialysis (HD)
    a. History of dialysis
    b. Define Hemodialysis
    c. Components of hemodialysis apparatus
    d. Mechanisms of hemodialysis
3. Peritoneal Dialysis (PD)
    a. History of Peritoneal Dialysis
    b. Define peritoneal dialysis.
    c. Components of peritoneal dialysis apparatus.
    d. Mechanisms of peritoneal dialysis.
4. Renal Transplantation
    a. History of organ transplantation (including Kidney)
    b. List & Define organ/tissue transplantation.
    c. Define kidney transplantation.
5. Normal Kidney & Dialysis
    a. Compare the normal kidney functions with dialysis.
    b. Indications for dialysis.
    c. Compare HD & PD
6. Conservative management
    a. Define conservative management & Palliative care.
    b. Methods of conservative management.
    c. Importance of conservative management.
    d. Palliative care for ESRD.
7. Introduction to Dialysis Unit
    a. Various areas in the dialysis unit and their importance
    b. Staff, job responsibilities
    c. Protocol to establish a dialysis unit.

Anatomy Practical's (60 Hours)

1. Introduction: Human body as a whole
    a. Histology of types of epithelium.
    b. Histology of serous, mucous & mixed salivary gland.
2. Locomotion and support
    a. Histology of the 3 types of cartilage.
    b. Demo of all bones showing parts, radiographs of normal bones & joints.
    c. Histology of compact bone (TS & LS).
    d. Demonstration of all muscles of the body.
    e. Histology of skeletal, smooth & cardiac muscle (TS & LS).

3. Cardiovascular system
    a. Demonstration of heart and vessels in the body.
    b. Histology of large artery, medium sized artery & vein, large vein.
    c. Histology of lymph node, spleen, tonsil & thymus.
    d. Normal chest radiograph showing heart shadows.
    e. Relationship to vascular access in dialysis
4. Gastro-intestinal system
    a. Demonstration of parts of gastrointestinal system.
    b. Normal radiographs of gastrointestinal system.
    c. Histology of gastrointestinal system.
5. Respiratory system
    a. Demonstration of parts of respiratory system.
    b. Normal radiographs of chest.
    c. Histology of lung and trachea.
6. Peritoneum
    a. Demonstration of reflections.
7. Urinary system
    a. Demonstration of parts of urinary system.
    b. Histology of kidney, ureter, urinary bladder.
    c. Radiographs of abdomen-IVP, retrograde cystogram.
8. Reproductive system
    a. Demonstration of section of male and female pelvis with organs in situ.
    b. Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube, ovary.
9. Endocrine glands
    a. Demonstration of the glands.
    b. Histology of pituitary, thyroid, parathyroid, suprarenal glands.
10. Nervous system
    a. Histology of peripheral nerve & optic nerve.
    b. Demonstration of all plexuses and nerves in the body.
    c. Demonstration of all parts of brain.
    d. Histology of cerebrum, cerebellum, spinal cord.
11. Sensory organs
    a. Histology of thin and thick skin.
    b. Demonstration and histology of eyeball.
    c. Histology of cornea & retina.
12. Embryology.
    a. Demonstration of models.

Physiology Practical's (60 Hours)

1. Hemoglobinometry.
2. White blood cell count.
3. Red blood cell count.
4. Determination of blood groups.
5. Leishman's staining and differential WBC count.
6. Determination of packed cell Volume.
7. Erythrocyte sedimentation rate (ESR).
8. Calculation of blood indices.
9. Determination of clotting time, bleeding time.
10. Blood pressure recording.
11. Auscultation for heart sounds.
12. Artificial respiration.
13. Determination of vital capacity.

Biochemistry Practical's (60 Hours)

1. Analysis of normal urine.
2. Composition of urine.
3. Procedure for routine screening.
4. Urinary screening for inborn errors of metabolism.
5. Common renal disease.
6. Urinary calculus.
7. Urine examination for detection of abnormal constituents.
8. Interpretation and diagnosis through charts.
9. Liver function tests.
10. Lipid profile.
11. Renal function test.
12. Cardiac markers.
13. Blood gas and electrolytes.
14. Estimation of blood sugar, blood urea, serum creatinine and electrolytes.
15. Demonstration of strips, demonstration of glucometer.
16. Titration of a simple acid and a base (preparation of standard solution of oxalic acid and using this solution finding out the normality of a sodium hydroxide solution. Acid to be titrated using this base Calculation of normality of an acid or a base after titration, measurement of hydrogen ion concentration.

Community orientation and clinical visit (CT) (90 Hours)

The objective of this particular section of the foundation course is to sensitize potential learners with essential knowledge; this will lay a sound foundation for their learning across the under-graduate program and across their career. Innovative teaching methods should be used to ensure the attention of a student and make them more receptive such as group activities, interactive fora, role plays, and clinical bed-side demonstrations.

1. The community orientation and clinical visit will include a visit to the entire chain of healthcare delivery systems -Sub center, PHC, CHC, SDH, DH and Medical college, private hospitals, dispensaries and clinics.

2. The student will also be briefed regarding governance at village level including interaction and group discussion with village panchayat and front-line health workers.
3. Clinical/ OPD visit to their respective professional departments within the hospital.

Second Semester

Pathology (60 Hours)

1. Introduction to pathology & basic terminologies

Terminologies

1. Introduction to pathology
2. Recognize the relevance of Pathology
3. Define the basic terminologies and branches of Pathology
    a. Aaetiology
    b. Pathogenesis
    c. Pathological and clinical manifestations
    d. Complications & sequelae
    e. Prognosis
    f. Syndrome
    g. Lesion
4. Explain the scope of the following branches of pathology:
    a. Histopathology
    b. Cytopathology
    c. Hematology

2. Cell injury & adaptation

Cell adaptation

Define cell growth, differentiation and cell. adaptation

Describe the various cell adaptations with examples.

a. Hypertrophy
b. Hyperplasia
c. Atrophy
d. Metaplasia
e. Dysplasia

Necrosis

1. Define necrosis
2. Describe the various types of necrosis with clinical examples

a. Coagulative necrosis
b. Colliquative necrosis/ Liquefactive necrosis
c. Caseous necrosis
d. Fibrinoid necrosis
e. Fat necrosis
f. Gangrene

3. Inflammation

Define inflammation. List the types with examples.

Acute inflammation

1. Define acute inflammation.
2. Describe the causes and cardinal signs of acute inflammation
3. Explain the vascular of acute inflammation.
4. Describe the cellular events in acute inflammation.
5. Explain the sequelae of acute inflammation.
6. Explain the beneficial, harmful and systemic effects of acute inflammation.

Chronic inflammation

1. Define chronic inflammation.
2. List the causes of chronic inflammation.
3. Describe the macroscopic and microscopic features in chronic inflammation.
4. List the cells in chronic inflammation.
5. Define granulomatous inflammation.
6. List the components of a granuloma and describe its morphology
7. List the causes of granulomatous inflammation.

4. Healing & repair

Wound healing

1. Define granulation tissue and describe the formation of granulation tissue.
2. Describe the following:
    a. Healing by first intention.
    b. Healing by second intention.
    c. Wound organization, contraction and scarring.
3. Explain the factors which modify (influence) healing and repair.

5. Fluid Hemodynamics

Oedema

1. Define oedema.
2. List the types of oedema.
3. Describe the pathogenesis and clinical features of the different types of oedema.

Shock

1. Define shock.
2. List the various types of shock.
3. Describe the pathogenesis of septic and hypovolemic shock.

Thrombosis (Arterial & Venous)

1. Define thrombosis.
2. Describe the factors influencing pathogenesis of thrombosis.
3. List causes of arterial and venous thrombosis.
4. List the fates of thrombus.

Embolism

1. Define embolism. List the types of embolism with examples.
2. Describe the clinicopathologic consequences of pulmonary thromboembolism

Infarction

1. Define infarction.
2. Describe the types and clinical significance of infarction.

6. Neoplasia
   1. Define neoplasia
   2. Describe the nomenclature of tumors with examples
   3. Define dysplasia and anaplasia
   4. Describe the differences between benign and malignant tumors
   5. Define carcinogenesis. List the types of carcinogens with example of each
   6. Describe the aetiology & predisposing factors of tumors
   7. Define metastasis.
   8. Describe the routes of metastasis with examples
   9. Describe the prognostic factors of tumors with emphasis on staging & grading
   10. Describe the various modalities for diagnosis of cancer
7. Infectious diseases

   Tuberculosis

   1. Describe the aetiology and mode of transmission of tuberculosis
   2. Describe the clinical features of tuberculosis.
   3. Describe the morphology of primary, secondary and miliary tuberculosis.

   Leprosy

   1. List the aetiological factors of leprosy
   2. Classify leprosy
   3. Describe the morphology of lepromatous and tuberculoid leprosy
8. Genetics
   1. Describe the basic concepts of genetics
   2. Define with suitable examples
      a. Autosomal dominant
      b. Autosomal recessive
      c. X-linked recessive
      d. Chromosomal abnormalities
   3. Define karyotyping
9. Blood vessels & heart

   Hypertension

   1. Define hypertension
   2. Classify hypertension
   3. Describe the effects of hypertension on various organs

   Atherosclerosis

   1. Define atherosclerosis
   2. List the sites of involvement by atherosclerosis
   3. Describe the predisposing factors, complications & clinical effects of atherosclerosis

   Ischemic heart disease/coronary artery disease

   1. Define ischemic heart diseases
   2. Describe the clinical spectrum of the disease (with reference to angina and myocardial infarction

   Aneurysm

   1. Define aneurysm
   2. List the causes, types and complications of aneurysms

Rheumatic heart disease

1. Define rheumatic heart diseases
2. Describe its aetiology & clinical features

Cardiac failure

1. Define cardiac failure
2. List the causes of cardiac failure
3. Describe its pathophysiology & clinical features

10. Respiratory system

Pneumonia

1. Define pneumonia
2. List the types of pneumonia
3. Describe the aetiology and clinical features of pneumonia

Chronic obstructive airway disease

1. Define chronic obstructive airway disease.
2. List the types of chronic obstructive airway Disease.

Emphysema

1. Define emphysema
2. List the types of emphysema
3. Describe the aetiology and clinical features of emphysema

Chronic bronchitis

1. Define chronic bronchitis
2. Describe the aetiology and clinical features of chronic bronchitis

Bronchiectasis

1. Define bronchiectasis
2. List the types of bronchiectasis.
3. Describe the aetiology and clinical features of bronchiectasis

Asthma

1. Define asthma
2. List the types of asthma
3. Describe the aetiology and clinical features of asthma

Pneumoconiosis

1. Define pneumoconiosis
2. List the types of pneumoconiosis
3. Describe the aetiology and clinical features of pneumoconiosis

11. Gastrointestinal tract & liver

Gastric & duodenal ulcers

1. Definition gastric and duodenal ulcer
2. Describe the aetiology, gross pathology and clinical features of gastric and duodenal ulcer

GIT malignancies

1. List the types of common GIT malignancies
2. Describe their predisposing factors & clinical features

Jaundice

1. Define jaundice
2. List the types of jaundice with examples

Viral hepatitis

1. Describe the aetiology of viral hepatitis
2. List the modes of infection
3. Describe the clinical features of viral hepatitis

Cirrhosis of liver

1. Define cirrhosis
2. List the causes of cirrhosis

Liver failure

1. Define liver failure
2. List the causes of liver failure
3. Describe its pathophysiology & clinical features

12. Renal system

Define nephrotic syndrome & nephritic syndrome with suitable examples

Renal failure

1. Define renal failure
2. List its types & describe the clinical features

13. Endocrine system

1. Define hyperthyroidism & hypothyroidism
2. Describe the causes, clinical features and laboratory diagnosis of hyperthyroidism and hypothyroidism
3. Describe the types, causes & clinical features of goiter
4. Describe types, clinical features, complications & laboratory diagnosis of diabetes

14. Nervous system

1. Define Cerebrovascular diseases
2. Describe its causes and clinical features

15. Musculoskeletal system

Fracture

1. Define fracture
2. List the types of fracture
3. Describe the process of fracture healing
4. List the factors influencing fracture repair

Osteomyelitis

1. Define osteomyelitis
2. Describe the aetiology, types and clinical features of osteomyelitis
3. Define and list the clinical features of Rheumatoid arthritis

16. Histopathology

1. Introduction to histopathology.
2. Receiving of specimen in the laboratory.
3. Grossing techniques.
4. Mounting techniques: various mountants.
5. Maintenance of records and filing of the slides.
6. Use & care of microscope.
7. Various fixatives, mode of action, preparation and indication.
8. Section cutting.
9. Tissue processing for routine paraffin sections.

10. Decalcification of tissues.
11. Staining of tissues: H & E Staining.
12. Bio-medical waste management.

17. Clinical Pathology

    1. Introduction to clinical pathology.
    2. Collection, transport, preservation, and processing of various clinical specimens.
    3. Urine Examination: collection and preservation of urine, physical, chemical, microscopic examination.
    4. Examination of body fluids.
    5. Examination of cerebro spinal fluid (CSF).
    6. Sputum examination.
    7. Examination of faeces.

18. Hematology

    1. Introduction to hematology.
    2. Normal constituents of blood, their structure and function.
    3. Collection of blood samples.
    4. Anticoagulants used in hematology.
    5. Instruments and glassware used in hematology, preparation and use of glassware.
    6. Laboratory safety guidelines.
    7. SI units and conventional units in hospital laboratory.
    8. Hb, PCV.
    9. ESR.
    10. Normal hemostasis.
    11. Bleeding time, clotting time, prothrombin time, activated partial thromboplastin time.

19. Blood Bank
    1. Introduction.
    2. Blood grouping and Rh types.
    3. Cross matching.

Microbiology (60 Hours)

1. Introduction To Medical Microbiology, Virology, Mycology & Parasitology
2. Morphology
    a. Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria.
3. Growth and nutrition
    a. Nutrition, growth and multiplications of bacteria, use of culture media in diagnostic bacteriology.
4. Culture media
    a. Use of culture media in diagnostic bacteriology, antimicrobial sensitivity test.

2. Sterilization and Disinfection
    a. Principles and use of equipment of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization, antiseptic and disinfectants.
5. Immunology
    a. Immunity, vaccines, types of vaccine and immunization schedule, principles and interpretation of common serological tests namely Widal, VDRL, ASLO, CRP, RF & ELISA.
    b. Rapid tests for HIV and HBsAg (excluding technical details).
6. Systematic Bacteriology
    a. Morphology, cultivation, diseases caused, laboratory diagnosis including specimen collection of the following bacteria (excluding classification, antigenic structure and pathogenicity), Staphylococci, Streptococci, Pneumococci, Gonococci, Meningococci, C. diphtheriae, Mycobacteria, Clostridia, Bacillus, Shigella, Salmonella, *E. coli*, Klebsiella, Proteus, Vibrio cholerae, Pseudomonas & Spirochetes.
7. Parasitology
    a. Morphology, life cycle, laboratory diagnosis of following parasites: *E. histolytica*, Plasmodium, tape worms, Intestinal nematodes.
8. Mycology
    a. Morphology, diseases caused and lab diagnosis of following fungi. Candida, Cryptococcus, Dermatophytes, opportunistic fungi
10. Virology
    a. General properties of viruses, diseases caused lab diagnosis and prevention of following viruses, Herpes, Hepatitis, HIV, Rabies and Poliomyelitis.
11. Hospital infection
    a. Causative agents, transmission methods, investigation, prevention and control of hospital infection.
12. Principles and practice Biomedical waste management

General Pharmacology (60 Hours)

1. General Pharmacology
    a. Introduction
    b. Routes of drug administration
    c. Pharmacokinetics
    d. Pharmacodynamics
    e. Drug toxicity and safety
2. Autonomic nervous system including skeletal muscle relaxants.
    a. Cholinergic drugs
    b. Anticholinergic drugs:
    c. Neuromuscular blocking drugs
    d. Adrenergic drugs
    e. Adrenergic receptor antagonists

3. Central nervous system
    a. General anesthetics (GAs)
    b. Local anesthetics (LAs)
    c. Sedative & hypnotics
    d. Opioids
    e. NSAIDs
    f. Drug treatment of rheumatoid arthritis (RA)
    g. Drug treatment of gout:
    h. Psychopharmacology
    i. Parkinsonism
    j. Alcohol
    k. Antiepileptic drugs
4. GIT
    a. Drugs for peptic ulcer
    b. Antiemetics
    c. Laxatives and antidiarrheals
5. Blood
    a. Hematinic
    b. Anticoagulants
    c. Antiplatelet drugs
    d. Fibrinolytics and antifibrinolytics
6. Cardiovascular system
    a. Diuretics
    b. Drugs used in congestive heart failure (CHF)
    c. Antihypertensives
    d. Antianginal drugs
    e. Hypolipidemic
7. Respiratory System
    a. Pharmacotherapy of bronchial asthma
    b. Pharmacotherapy of cough
    c. Antihistaminic
8. Chemotherapy
    a. General aspects
    b. Beta lactam antibiotics
    c. Cotrimoxazole
    d. Macrolides
    e. Fluoroquinolones
    f. Antifungal agents
    g. Antiviral drugs
    h. Antitubercular drugs
    i. Antileprotic drugs
    j. Aminoglycosides
    k. Antiamoebic drugs
    l. Anthelmintics
    m. Antimalarial drugs

9. Hormones and related drugs
    a. Glucocorticoids
    b. Antidiabetic drugs
    c. Thyroid and anti-thyroid drugs
10. Immunosuppressors and Immunomodulators

Applied anatomy & physiology related to Dialysis Therapy (60 Hours)

Applied anatomy.

1. Basic anatomy of urinary system: structural anatomy of kidney, bladder, ureter, urethra, prostate.
2. Histology of kidney.
3. Blood supply of kidney.
4. Development of kidney in brief.
5. Anatomy of peritoneum including concept of abdominal hernias.
6. Anatomy of vascular system:
    a. Upper limb vessels: course, distribution, branches, origin & abnormalities.
    b. Neck vessels: course, distribution, branches, origin & abnormalities.
    c. Femoral vessels: course, distribution, branches, origin & abnormalities.
    d. Artery & Veins used for dialysis.
7. Histology of bladder, urethra
8. Innervation of urinary bladder

Physiology

1. Mechanism of urine formation.
2. Glomerular filtration rate (GFR).
3. Clearance studies.
4. Physiological values of urea, creatinine, electrolytes, calcium, phosphorous, uric acid, magnesium, glucose; 24 hours urinary indices – urea, creatinine, electrolytes, calcium, magnesium.
5. Physiology of renal circulation
    a. Factors contributing & modifying renal circulation.
    b. Auto regulation.
6. Hormones produced by kidney & physiologic alterations in pregnancy.
7. Haemostasias: coagulation cascade, coagulation factors, auto regulation, BT, CT, PT, PTT, thrombin time.
8. Acid base balance: basic principles & common abnormalities like hypokalemia, hyponatremia, hyperkalemia, hypernatremia, hypocalcemia, hypercalcemia, pH, etc.
9. Basic nutrition in renal diseases.
10. Basics of ECG, ECHO
11. Juxta Glomerular Apparatus
12. Micturition reflux

Fundamentals of Dialysis Therapy (45 Hours)

1. Indications of dialysis.
2. Types of dialysis.
   List the types of Hemodialysis
   List the types of Peritoneal dialysis
3. Principles of Hemodialysis
   Define Hemodialysis Principles
   Discuss the application of diffusion in HD and list the factors affecting diffusion
   Discuss ultrafiltration and convection in hemodialysis and factors affecting them
   List the factors affecting solute clearance in HD
   Define Kuf & KoA
4. Principles of Peritoneal Dialysis
   Define Peritoneal Dialysis Principles
   Discuss the application of diffusion in PD and list the factors affecting diffusion
   Discuss ultrafiltration/ Osmosis, convection and fluid absorption in Peritoneal Dialysis and factors affecting them
   List the factors affecting solute clearance in PD
5. Hemodialysis Apparatus
   Vascular Access
   Water Treatment Plant
   Extracorporeal Blood Circuit
   HD machine
   Dialysate
6. Basics of Semipermeable membrane & Peritoneal Membrane
   Define semipermeable membrane
   List the properties of a semipermeable membrane
   List the importance of biological semipermeable membrane
   List the importance of semipermeable membrane in the field of dialysis – HD & PD
   Define biocompatibility and explain its importance in the dialysis field
   Discuss the factors affecting the permeability of the semipermeable membrane in HD & PD
7. Peritoneal Dialysis Apparatus.
   PD Access
   PD fluid
   PD Cyclers
8. Introduction to hemodialysis machine.
   Electronics Circuit
   Hydraulics Circuit
   Alarms in HD machine
9. Priming of dialysis apparatus.
   Purpose
   Assembling
   Steps for priming HD apparatus.

10. Dialyzer reuse.
    Chemicals Used
    Purpose
    Advantages and Disadvantages
    Steps involved in reuse
11. Common complications of hemodialysis.
12. Monitoring patients during dialysis.

Pathology Practical's (30 Hours)

1. Urine Examination: physical, chemical, microscopic.
2. Blood grouping Rh typing.
3. Hb estimation, packed cell volume (PCV), erythrocyte sedimentation rate (ESR).
4. Bleeding time, clotting time.
5. Histopathology: section cutting and H &E staining.
   Renal Biopsy Slides

Microbiology Practical's (30 Hours)

1. Compound microscope.
2. Demonstration of sterilization equipment's: hot air oven, autoclave, bacterial filters.
3. Demonstration of commonly used culture media, nutrient broth, nutrient agar, blood agar, chocolate agar, MacConkey medium, L J media, Robertson cooked meat media, Potassium tellurite media with growth, MacConkey medium with LF & NLF, NA with staph.
4. Anaerobic culture methods.
5. Antibiotic susceptibility test.
6. Demonstration of common serological tests: Widal, VDRL, ELISA.
7. Gram staining.
8. Acid fast staining.
9. Fungal Staining
10. Stool exam for helminthic ova & cysts.
11. Visit to hospital for demonstration of work done by infection control team and biomedical waste management department.

Applied Anatomy & Physiology related to dialysis therapy practical's (30 Hours)

Applied Anatomy

1. Urinary system
   e. Demonstration of parts of urinary system.
   f. Histology of kidney, ureter, urinary bladder.
   g. Radiographs of abdomen-IVP, retrograde cystogram.

b. Development of Kidney

c. Peritoneum
   a. Demonstration of reflections.

d. Anatomy of vascular system:
    a. Upper limb vessels.
    b. Neck vessels
    c. Femoral vessels
    d. Artery & Veins used for dialysis.

Applied Physiology

1. Estimation of GFR
2. Hemoglobinometry.
3. Determination of clotting time, bleeding time.
4. Blood pressure recording.
5. Auscultation for heart sounds.
6. Interpretation of ECG & ECHO

Fundamentals of Dialysis Therapy Practical's (30 Hours)

1. HD Apparatus Spotters
   Vascular Access
   Water Treatment Plant
   Extracorporeal Blood Circuit
   HD machine
   Dialysate
2. Priming of Dialysis Apparatus
   Assembling
   Steps for priming HD apparatus
3. Dialyzer reuse
   Steps involved in reuse
4. Monitoring during dialysis
   Patient Monitoring
   Vitals
5. Managing complications during dialysis.
6. Understanding Dialysis Blood Circuit.

Clinical Postings- I (135 Hours)

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior dialysis therapist. Students are tested on intermediate clinical dialysis therapy skills.

Areas to be covered.

1. OPD
2. Dialysis Unit
3. Procedure room for assisting in Renal Biopsy.