

**Maharaja Ranjit Singh Punjab Technical University
Bathinda-151001**



FACULTY OF PHARMACY

SYLLABUS

FOR

M.SC. (DIALYSIS TECHNOLOGY)

(2 YEARS PROGRAMME)

2023 BATCH ONWARDS

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**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
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SCHEME

1 st Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Int.	Ext	Total	
MDLTS1-101	Anatomy & Physiology in Renal-I	3	1	0	40	60	100	4
MDLTS1-102	Nutrition	3	1	0	40	60	100	4
MDLTS1-103	Pharmacology in Renal	3	1	0	40	60	100	4
MDLTS1-104	Anatomy & Physiology in Renal-I Practical	0	0	4	60	40	100	2
MDLTS1-105	Nutrition-Practical	0	0	4	60	40	100	2
MDLTS1-106	Introduction to Clinical-Practical	0	0	4	60	40	100	2
Total		9	3	12	300	300	600	18

2 nd Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Int.	Ext	Total	
MDLTS1-201	Anatomy & Physiology in Renal-II	3	1	0	40	60	100	4
MDLTS1-202	Imaging in Kidney Diseases	3	1	0	40	60	100	4
MDLTS1-203	Biomedical Instrumentation & Dialysis Equipment	3	1	0	40	60	100	4
MDLTS1-204	Anatomy & Physiology in Renal-II Practical	0	0	4	60	40	100	2
MDLTS1-205	Imaging in Kidney Diseases-Practical	0	0	4	60	40	100	2
MDLTS1-206	Biomedical Instrumentation & Dialysis Equipment-Practical	0	0	4	60	40	100	2
Total		9	3	12	300	300	600	18

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3 rd Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Int.	Ext	Total	
MDLTS1-301	Nephrology & Kidney Disease	3	1	0	40	60	100	4
MDLTS1-302	Emergency Medicines	3	1	0	40	60	100	4
MDLTS1-303	Hemodialysis	3	1	0	40	60	100	4
MDLTS1-304	Peritoneal Dialysis	3	1	0	40	60	100	4
MDLTS1-305	Renal Transplantation	3	1	0	40	60	100	4
MDLTS1-306	Nephrology & Kidney Disease & Emergency Medicines-Practical	0	0	4	60	40	100	2
MDLTS1-307	Hemodialysis & dialysis equipment-Practical	0	0	4	60	40	100	2
MDLTS1-308	Peritoneal Dialysis & Renal transplantation-Practical	0	0	4	60	40	100	2
Total		15	5	12	380	420	800	26

4 th Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Int.	Ext	Total	
MDLTS1-401	Thesis and Dissertation	0	0	40	80	120	200	20

The candidate shall undergo an internship of six months in the relevant department. The internship report shall be submitted to the principal & Viva-Voce examination shall be conducted by an external expert.

Overall Marks / Credits

Semester	Marks	Credits
1 st	600	18
2 nd	600	20
3 rd	800	26
4 th	200	20
Total	2200	84

FIRST SEMESTER

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
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ANATOMY & PHYSIOLOGY IN RENAL-I

Subject Code: MDLTS1-101

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Outcomes:

- To provide a comprehensive understanding of the anatomy and physiology of the urinary tract and kidney.
- To familiarize students with the embryology and fetal development related to the urinary system.
- To explain the physiological mechanisms involved in kidney function, including glomerular filtration, tubular reabsorption, and tubular secretion.
- To introduce the concept of peritoneal dialysis and the physiological aspects of peritoneal membrane transport.

Unit: 1 (10 hrs)

Anatomy of Urinary Tract & Kidney: Gross anatomy of the kidney, Location of kidney, Size, Protection, and Structure of the kidney – gross structure blood supply, nerve supply, lymphatic flow, L.S of Kidney.

Unit: 2 (10 hrs)

Embryology and fetal development in brief. Anatomy of peritoneum: Description Size, Nature, Blood supply, Lymphatic drainage

Unit: 3 (10 hrs)

Physiology of Kidney: Basic concepts Glomerular filtration, renal auto regulation of blood supply & GFR clearance, Tubular reabsorption, Aldosterone, ADH & water homeostasis, Tubular secretion, Maximal tubular transport capacity

Summary of major functions of Nephron & its components in urine formation: Glomerulus, PCT, Henley's loop (Descending limb & thick ascending limb), DCT Collecting duct: Cortical, Medullary.

Unit: 4 (15 hrs)

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

Physiology of peritoneum during P.D. Diffusion through the peritoneum: Definition, Factors influencing solute transport- Peritoneal permeability, Solute characteristics, Concentration gradient, Peritoneal blood flow, Dialysis solution temperature, and Available membrane area.

Unit: 5 (15 hrs)

Osmosis through the peritoneal membrane. Ultrafiltration, Drug transport

Composition and function of blood – Introduction Red blood cells: Erythropoiesis, stages of differentiation function, count physiological, variation. Hemoglobin: structure, functions, concentration physiological variation methods of Estimation of Hb White blood cells: Production, function, life span, count, differential count Platelets: Origin, normal count, morphology functions.

Reference books-

1. Principles of Renal Physiology
2. Principles of Physiology – Devasis Pramanik, 5th edition.
3. Human Physiology for BDS –Dr A.K. Jain, 5th edition.
4. Textbook of Medical Physiology, Guyton , 2nd South Asia Edition.
5. Textbook of Physiology Volume I & II – Dr. A. K. Jain.
6. Comprehensive textbook of Medical Physiology Volume I & II – Dr. G. K. Pal.
7. Basics of medical Physiology –D Venkatesh and H.H Sudhakar, 3rd edition.

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NUTRITION

Subject Code: MDLTS1-102

**L T P C
3 1 0 4**

Duration: 60 (Hrs.)

Course Outcomes:

- Students will be able to apply the principles of nutritional assessment to design and evaluate nutritional assessment systems, considering reference distribution, limits, and cutoff points.
- Students will acquire the skills to select appropriate methods for measuring food consumption and evaluating nutrient intake data, including the use of recommended nutrient intake tables and probability approaches.
- Students will develop an understanding of clinical dietetics and its applications, enabling them to prescribe diets for specific health conditions and manage nutrition-related disorders.
- Students will gain knowledge of anthropometric assessment techniques and growth measurements.

Unit: 1 (15 Hrs.)

Principles of Nutritional Assessment: Introduction, Nutritional assessment system, Methods used in nutritional assessment, the design of nutritional assessment system, Evaluation of nutritional assessment indices. Reference distribution, Reference limits, Cutoff points.

Food consumption of Individual: Methods, New development in measuring food consumption, selecting an appropriate method, Summary, Evaluation of nutrient intake data, Tables of recommended nutrient intakes, Evaluating Nutrient intakes of individuals, Evaluating the nutrient intakes of population groups, Probability approach to evaluating nutrient intakes.

Unit: 2 (15 Hrs.)

Renal Nutrition: Part I Nutrition: Energy (Calories), Protein, Lipid (Fats& Cholesterol), Carbohydrates, Thiamine vitamin B1, aneurine, Riboflavin, Vitamin B6 (pyridoxine, adermin), Nicotinic acid (Niacin, nicotinamide), Folic acid (folate, folacin, pteroylglutamic acid), Vitamin b12 (cobalamin), Pantothenic acid(filtrate factor), Choline, biotin, Ascorbic acid (vitamin C), Vitamin A, Vitamin D, Vitamin E, Vitamin K, Bioflavonoid (vitamin P), Sodium, Potassium, Iron, Calcium, Phosphate, Magnesium, Manganese, Iodine, Copper, Cobalt, Chloride, Fluoride, trace elements, Dietary Fibers, Water.

Part II: Foods: Wheat, Rice, Pulses, Soya beans, Maize, Millets, Milk, Egg, Meats, Nuts & Dried Fruits, Sweet foods & sweetening agents, Fish, Vegetables, Fruits, Spices, Beverage.

Unit: 3 (15 Hrs.)

Clinical dietetics: Diet Prescription, Peptic ulcer, Flatulence, Constipation, Diarrhea & dysentery, Protein- Energy malnutrition, Anemic, underweight Obesity, Diabetes mellitus, Kidney disease, Renal failure, Kidney stones, Coronary Heart Diseases and atherosclerosis, High BP, Congestive cardiac failure, Tube feeding.

Anthropometric assessment: Advantages and limitations of anthropometric assessment, Sources of error in nutritional anthropometry, Evaluation of anthropometric indices, Anthropometric assessment of growth, Growth measurement, Indices derived from growth measurements.

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Unit: 4 (15 Hrs)

Evaluation of nutrient intake data: Tables of recommended nutrient intakes, Evaluating Nutrient intakes of individuals, evaluating the nutrient intakes of population groups, Probability approach to evaluating nutrient intakes.

Reference books:

1. Jelliffe, D. B.: Assessment of the Nutritional Status of the Community; World Health Organization.
2. Mahan, L.K. and Escott- Stump, S. (2000): Krause's Food Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.
3. Shils, M.E., Olson, J.A., Shike, M. and Ross, A.C. (1999): Modern Nutrition in Health and Disease, 9th Edition, Williams and Wilkins.
4. Williams, S.R. (1993): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby College Publishing.

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PHARMACOLOGY IN RENAL

Subject Code: MDLTS1-103

L T P C
3 1 0 4

Duration: 60 (Hrs.)

Course Outcomes:

- Students will be able to identify and describe the medications commonly used by patients with renal failure, including their mechanisms of action, appropriate dosages, potential side effects, and contraindications.
- Students will gain knowledge of the pharmacokinetic and pharmacodynamic principles relevant to renal disease, enabling them to understand how medications are absorbed, distributed, metabolized, and eliminated in patients with compromised renal function.
- Students will develop a comprehensive understanding of hemodialysis and peritoneal dialysis, including the use of specific medications, dialysis concentrates, and potassium exchange resins,
- Students will develop an understanding of various dialysis techniques and medications along with appropriate administration methods and potential adverse effects.

Unit: 1 (10 hrs.)

Medications commonly used by patient with renal failure: Antacids and phosphate binders, Anti anemic drugs, Anticoagulants, Antihypertensives

Unit: 2 (10 hrs.)

Medications commonly used by patient with renal failure: Antimicrobials, Antipruritis, Cardiovascular drugs, Chelating agents, Electrolytes, Laxatives and, Local anesthetics, Potassium ion exchange resin, Thrombolytic agents, Vitamins

Unit: 3 (10 hrs.)

Pharmacology related to Renal disease: Pharmacokinetic and Pharmacodynamic principles, IV fluid therapy with special emphasis in renal disease.

Diuretics–Classification, actions, dosage, side effects & contraindications

Unit: 4 (15 hrs)

Antihypertensive–Classification, action, dosage, side effects & contraindications, special reference during dialysis, vasopressors, Drugs used in hypotension.

Drugs & Dialysis–Dose & duration of administration of drugs

Dialysable drugs–Phenobarbitone, Lithium, Methanol etc

Vit D & its analogues, phosphate binders, iron, folic acid & other vitamins of therapeutic value

Erythropoietin in detail.

Unit: 5 (15 hrs)

Hemodialysis and Peritoneal dialysis: Heparin including low molecular weight heparin, Protamine sulphate, Gluteraldehyde, sodium hypochlorite, hydrogen peroxide role as disinfectants & adverse effects of residual particles applicable to gluteraldehyde

Haemo dialysis concentrates – composition & dilution (Acetate & bicarbonates)

PD fluid in particular hypertonic solutions composition (Dextrose, icodextrin solutions)

Potassium exchange resins with special emphasis on mode of administration.

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Reference books:

1. Daugridas J. T. Handbook of dialysis technology, 7th ed.
2. Danovitch, Handbook of Renal Transplantation, 6th ed.
3. Dialysis Technology – A Manual for Dialysis Technicians by Jim Curtis, Philip Varghese
4. National Kidney foundation
5. Essentials of Medical Pharmacology – Tripathi

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ANATOMY & PHYSIOLOGY IN RENAL-I PRACTICAL

Subject Code: MDLTS1-104

**L T P C
0 0 4 2**

Duration: 4Hrs./Week

Course Outcomes:

- Students will be able to demonstrate knowledge of the principles and concepts underlying the identification tests for macronutrients.
- Students will acquire practical skills in conducting qualitative tests for carbohydrates, proteins, lipids, minerals, and vitamins, and be able to interpret the results obtained from these tests.
- Students will understand the physiological significance of macronutrients in human metabolism and health.
- Students will develop critical thinking skills to troubleshoot and refine experimental procedures for nutrient identification.

Experiments related to:

- Formation of urine by kidney
- Renal associated mechanism for controlling extracellular fluid osmolality and sodium concentration
- Renal regulation of Blood volume and extracellular fluid Volume, Excretion and regulation of urea, potassium, and other substances, Regulation of Acid-Base Balance

Reference Books:

1. Manipal Manual of Anatomy for Allied Health Sciences courses: Madhyastha S.
2. G.J. Tortora & N.P. Anagnostakos: Principles of Anatomy and Physiology
3. B.D. Chaurasia: Handbook of General Anatomy

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NUTRITION PRACTICAL

Subject Code: MDLTS1-105

L T P C
0 0 4 2

Duration: 4Hrs./Week

- **Course Outcomes:** Students will be able to apply the principles of nutritional assessment to design and evaluate nutritional assessment systems, considering reference distribution, limits, and cutoff points.
- Students will acquire the skills to select appropriate methods for measuring food consumption and evaluating nutrient intake data, including the use of recommended nutrient intake tables and probability approaches.
- Students will develop an understanding of clinical dietetics and its applications, enabling them to prescribe diets for specific health conditions and manage nutrition-related disorders.
- Students will gain knowledge of anthropometric assessment techniques and growth measurements.

Experiments:

- Introduction and identification tests for Macronutrients
- Qualitative tests for Carbohydrates
- Qualitative tests for Protein
- Qualitative tests for Lipids
- Qualitative tests for Minerals & Vitamins

Reference books:

1. Jelliffe, D. B.: Assessment of the Nutritional Status of the Community; World Health Organization.
2. Mahan, L.K. and Escott- Stump, S. (2000): Krause's Food Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.

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INTRODUCTION TO CLINICAL PRACTICAL

Subject Code: MDLTS1-106

L T P C
0 0 4 2

Duration: 4Hrs./Week

Course Outcomes:

- Demonstrate proficiency in adjusting variable bicarbonate settings based on specific indications in dialysis.
- Apply appropriate isolated UF settings based on patient needs and clinical indications in dialysis.
- To learn about various diagnostic tests related to subject.

Experiment:

- Variable bicarbonate settings and indication
- Isolated UF settings and indications
- Advanced options – BVM, BTM and Single-needle Haemodialysis
- APD Machine settings
- PET test (Peritoneal Dialysis)
- Adding medicines in PD bags
- Assisting Venovenous catheter insertion

Reference books:

1. Jelliffe, D. B.: Assessment of the Nutritional Status of the Community; World Health Organization.
2. Mahan, L.K. and Escott- Stump, S. (2000): Krause's Food Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.
3. Shils, M.E., Olson, J.A., Shike, M. and Ross, A.C. (1999): Modern Nutrition in Health and Disease, 9th Edition, Williams and Wilkins.
4. Williams, S.R. (1993): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby College Publishing.

SECOND SEMESTER

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ANATOMY & PHYSIOLOGY IN RENAL-II

Subject Code: MDLTS1-201

L T P C
3 1 0 4

Duration: 60 (Hrs.)

Course Objectives:

- To develop a comprehensive understanding of the anatomy and microscopic structure of the urinary system, including the kidney, ureter, bladder, urethra, sphincters, and prostate.
- To explore the anatomy of the vascular system related to hemodialysis, focusing on the upper limb vessels, neck vessels, and femoral vessels, including their course, distribution, branches, origin, and abnormalities.
- To examine the regulatory mechanisms of the renal system, including water regulation, electrolyte regulation, and the regulation of acid-base balance. Additionally, to understand the role of renal hormones such as vitamin D, erythropoietin, renin, and prostaglandins.

Course Outcomes:

- Students will be able to describe the structural anatomy of the urinary system, including the kidney and its various components, and understand their functions in the excretory process.
- Students will be able to identify and describe the anatomy of the vascular system relevant to hemodialysis, including the course, distribution, branches, and abnormalities of major vessels.
- Students will gain an understanding of the regulatory mechanisms involved in the renal system, including water and electrolyte balance, acid-base regulation, and the role of renal hormones. They will be able to explain the physiological processes and abnormalities associated with these mechanisms.

Unit: 1 (12 Hrs)

Basic anatomy of urinary system: The Kidney (structural anatomy), ureter, bladder, urethra, Sphincters, Prostate.

Microscopic anatomy: Nephron: Glomerular structure, tubules Interstitium, Juxta Glomerular apparatus.

Unit: 2 (12 Hrs)

Anatomy of Vascular system related to Hemodialysis: Upper limb vessels (Course, distribution, branches, origin, and abnormalities), Neck vessels (Course, distribution, branches, origin, and abnormalities), Femoral vessels (Course, distribution, branches, origin, and abnormalities).

Unit: 3 (12 Hrs)

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

Renal hormones & Vit D, erythropoietin, Renin, Prostaglandins.

Unit: 4 (10 Hrs)

Routes of solute transport: Intracellular, Extracellular.

Factors that enhance diffusion: Increased dialysis solution flow, increased blood flow, High concentration gradient, Pre-warmed dialysis solution, Osmotic pressure.

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Hemostasis – basic principles Coagulation cascade, Coagulation factors, Regulation of procoagulants & anticoagulants BT, CT, PT, PTT, thrombin time.

Unit: 5 (14 Hrs)

Plasma Proteins – Production, concentration, types, albumin, globulin, Fibrinogen, prothrombin functions. Hemostasis & Blood coagulation: Hemostasis: Definition, normal hemostasis, clotting factors, mechanism of clotting, disorders of clotting factors. Blood Bank: Blood groups – ABO system, Rh system Blood grouping & typing Cross matching: Rh system – Rh factor, Rh in compatibility. Blood transfusion – Indication, universal donor and recipient concept. Selection criteria of a blood donor. transfusion reactions Anticoagulants – Classification, examples and uses Anemia's: Classification – morphological and etiological. Effects of anemia on body Erythrocyte sedimentation Rate (ESR) and Packed cell volume load Volume: Normal value, determination of blood volume and regulation of blood Volume Body fluid: pH, normal value, regulation and variation Lymph: lymphoid tissue formation, circulation, composition and function of lymph.

Reference books-

1. Principles of Renal Physiology
2. Principles of Physiology – Devasis Pramanik, 5th edition.
3. Human Physiology for BDS –Dr A.K. Jain, 5th edition.
4. Textbook of Medical Physiology, Guyton , 2nd South Asia Edition.
5. Textbook of Physiology Volume I & II – Dr. A. K. Jain.
6. Comprehensive textbook of Medical Physiology Volume I & II – Dr. G. K. Pal.
7. Basics of medical Physiology –D Venkatesh and H.H Sudhakar, 3rd edition.

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IMAGING IN KIDNEY DISEASES

Subject Code: MDLTS1-202

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Objectives:

- To understand the principles and techniques of emergency medicine and Advanced Cardiac Life Support (ACLS), including the importance of timely medical interventions and the role of the American Heart Association.
- To develop knowledge and skills in assessing and managing cardiovascular and respiratory emergencies, including CPR techniques, airway management, and the use of automated external defibrillation.
- To explore special resuscitation situations and pediatric BLS, including stroke, trauma, near-drowning, and cardiac arrest associated with specific conditions, and to learn the unique techniques and considerations for resuscitation in these cases.

Course Outcomes:

- Students will be able to demonstrate competence in providing basic life support and ACLS techniques, including CPR, airway management, and automated external defibrillation.
- Students will understand the ethical and legal considerations in emergency medicine, including decision-making, CPR initiation and discontinuation, and safety measures during training and actual rescue situations.
- Students will gain knowledge and awareness of specific resuscitation situations and pediatric BLS, enabling them to effectively respond to emergencies involving stroke, trauma, drowning, and other unique circumstances.

Unit: 1 (12 Hrs)

- **Emergency medicine/ACLS/ renal nutrition:** BLS in perspective- The need for Medical interventions, The ultimate Coronary Care Unit, Emergency Cardiac Care, The chain of Survival, Role of the American Heart Association
- Cardio Pulmonary Function and actions for survival - The Cardiovascular and Respiratory system, Action for survival
- Risk factors and prudent Heart living- Risk factors for Heart Attack, Prudent Heart Living, Summary: The role of Prevention

Unit: 2 (12 Hrs)

- **Adult BLS:** Citizen response to Cardio-pulmonary Emergency, Indication for BLS, The sequence of BLS; Assessment, EMS activations and the ABC of CPR, CPR performed by one rescuer and two rescuers, Foreign – Body airway obstruction Management, CPR: The Human Dimension, BLS Research Initiative
- **Ethical and Legal considerations-** Values in Decision Making, Instituting and Discontinuing CPR, Legal mandates, Conclusions, Safety during CPR Training and actual rescue, Disease transmission during CPR Training, Disease transmission during actual performance of CPR, Automated External Defibrillation, Importance of Automated External Defibrillation, Overview of Automated External Defibrillation, Advantage and Disadvantage of Automated External Defibrillation, Use of Automated External

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Defibrillation during Resuscitation attempts, Automated External Defibrillation treatment algorithm, Post resuscitation care, Training, Maintenance of Skills, Medical control, Quality assurance

Unit: 3 (12 Hrs)

- Special Resuscitation Situation: Stroke, Hypothermia, Near – Drowning, Cardiac arrest associated with Trauma, Electric shock and lightning stroke, Pregnancy, Asphyxiation, Special techniques and pitfalls and complication, Unique situation
- Pediatric BLS- Epidemiology, Injury prevention, Prehospital care, The sequence of Pediatric BLS - the ABC of CPR, Activation of the EMS system obstructive, Foreign Body airway, BLS in Trauma

Unit: 4 (12 Hrs)

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

Unit: 5 (12 Hrs)

- Critical Care: Respiratory Failure: General considerations-pathophysiology-Blood gas analysis, Oxygen therapy: Nasal prongs-venturi masks- Nonrebreathing masks-A continuous positive airway pressure mask-Bilevel positive airway pressure, Airway Management and Tracheal Intubation: Airway Management-Endotracheal intubation-Surgical airways, Mechanical Ventilation: Indications-Initiation of mechanical ventilation- Management of problems and complications-Weaning from mechanical ventilation- Drugs commonly used during endotracheal intubation and mechanical ventilation, Shock: Resuscitative Principles-Individual shock states, Hemodynamic Monitoring and Pulmonary Artery Catheterization: Indications obtaining, pulmonary capillary wedge tracing-acceptance of PAOP reading transmural, pressure-Cardiac output-Interpretation of hemodynamic readings
- Cardiac Arrhythmias- Recognition and Management: Clinical diagnosis of arrhythmias Electrocardiographic data- Bradyarrhythmias- premature complexes-Tachycardia. Antiarrhythmic Drug Therapy: General Principles-Antiarrhythmic agents, Related Topics: Syncope-Electro cardioversion-Cardiac pacing-Anti-tachycardia devices

Reference books:

1. Sutton, Textbook of Radiology and Imaging, 7th ed.
2. Harrison's Principles of Internal Medicine, 20th ed.
3. Manual of Nephrology, Robert Schrier Reference books or related websites: Oxford Handbook of Nephrology, 2nd ed.

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BIOMEDICAL INSTRUMENTATION & DIALYSIS EQUIPMENT

Subject Code: MDLTS1-203

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Objectives:

- Students will be able to grasp the fundamental concepts and components of biomedical instrumentation, including transducers and their applications in the field of biomedicine.
- Students will gain knowledge about the sources of bioelectric potentials, such as resting and action potentials, and understand the theory behind various types of electrodes used in biomedical instrumentation.
- Students will learn about the physiological effects of electrical current, methods of accident prevention, patient care and monitoring techniques, and the importance of electrical safety in the context of medical equipment.

Course Outcomes:

- Ability to analyze and apply transducer principles in biomedical applications.
- Proficiency in utilizing bioelectric potentials and electrodes for biomedical measurements.
- Understanding of electrical safety practices and patient care in medical equipment.

Unit: 1 (15 Hrs)

- Introduction to Biomedical Instrumentation: The Age of Biomedical Engineering, Development of BM instrumentation, Biometrics, Introduction to the man-instrument system, Components of the man-instrument system physiological systems of the body, Problems encountered in measuring a living system
- Basic Transducer principles: The transducer and transduction principles, Active transducers, Passive transducers, Transducers for Biomedical applications

Unit: 2 (15 Hrs)

- Sources of Bioelectric potentials: Resting and action potentials, Propagation of Action potentials, The Bioelectric potentials
- Electrodes: Electrode theory, Biopotential electrodes, Biochemical transducers
- The computer in Biomedical Instrumentation: The digital computer - Computer Hardware, Computer software. Microprocessors - Types of microprocessors, Microprocessors in Biomedical Instrumentation- Calibration , Table lookup , Averaging , Formatting and printout, Interfacing the computer and medical instrumentation and other equipment.- Digital interfacing requirement , Analog-to-digital and Digital-to-Analog conversion, Biomedical computer application - Data acquisition, storage and retrieval, data reduction and transformation, mathematical operation, pattern recognition, limit detection, statistical analysis of data, data presentation ,control function – Computer analysis of the ECG, the digital computer in the clinical chemistry laboratory, digital computerized in hemodialysis machine, other computer application

Unit: 3 (15 Hrs)

- Electrical safety of Medical Equipment: Physiological effects of electrical current, Shock hazards from electrical equipment, Methods of accident prevention- Grounding, Double

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insulation, Protection by low voltage, Ground – fault circuit interrupter, Isolation of patient – connected parts Isolated power distribution systems

- Patient care and monitoring: The elements of intensive – care monitoring, Patient monitoring displays, Diagnosis, calibration and reparability of patient – monitoring equipment, Other instrumentation for monitoring patients, The organization of the hospital for patient care monitoring, Defibrillator, Description of Machine self test, Technical safety checks and maintenance, General notes, Technical safety checks and maintenance procedures maintenance checklist

Unit: 4 (15 Hrs)

Adjustment: Overview of the Dip switches, Calibration mode, Hydraulics, Dir detector, Calibration Program, Diagnostics Program, General notes, Setup Menu- Overview, Main menu, Circuit diagram and circuit description, Block diagram, level detector control (LD), BLD, Mother board, CPU, Input / output board, Display board, Power supply, Hep - Module

Reference books:

1. Dialysis Technology – A Manual for Dialysis Technicians by Jim Curtis, Philip Varughese.
2. Introduction to Biomedical Equipment Technology by Joseph J.Carr, John m. Brown

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ANATOMY & PHYSIOLOGY IN RENAL-II PRACTICAL

Subject Code: MDLTS1-204

L T P C

Duration: 60 (Hrs.)

0 0 4 2

Course Objectives:

- To develop a comprehensive understanding of vital signs, including pulse, blood pressure, temperature, respiratory rate, and pulse oximetry, and their significance in healthcare.
- To provide students with practical skills in examining the chest through techniques such as inspection, percussion, palpation, and auscultation, enabling them to assess respiratory health effectively.

Course Outcomes:

- Students will be able to accurately measure and interpret vital signs, demonstrating proficiency in assessing the physiological condition of patients.
- Students will gain proficiency in conducting thorough examinations of the chest, utilizing various techniques to evaluate respiratory health and detect abnormalities.
- Students will acquire knowledge of laboratory tests, including arterial blood gases, reference ranges, and the ability to interpret abnormal values, enhancing their diagnostic skills and understanding of patient care.

Experiments:

- Vital Signs (Pulse, Blood Pressure, Temperature, Respiratory Rate, Pulse Oximetry)
- Examination of the Chest (Inspection, Percussion, Palpation, Auscultation).
- Laboratory Tests - Reference ranges and interpretation of abnormal values, Arterial Blood Gases.

Reference books:

1. Manipal Manual of Anatomy for Allied Health Sciences courses: Madhyastha S.
2. G.J. Tortora & N.P. Anagnostakos: Principles of Anatomy and Physiology
3. B.D. Chaurasia: Handbook of General Anatomy

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

IMAGING IN KIDNEY DISEASES PRACTICAL

Subject Code: MDLTS1-205

**L T P C
0 0 4 2**

Duration: 60 (Hrs.)

Course Objectives:

- The objective of this course is to provide students with comprehensive knowledge and practical skills in the field of dialysis. By the end of the course, students will be able to understand the principles and techniques involved in dialysis treatment and demonstrate proficiency in managing dialysis units.

Course Outcomes:

- Understand the functioning and operation of a dialysis room, including the equipment and instruments used in the process.
- Gain knowledge about water treatment plants and their significance in maintaining the quality of water used for dialysis.
- Acquire basic skills in electronics, plumbing, and computer systems relevant to dialysis equipment and infrastructure.
- Develop an understanding of the principles and practices involved in the management of a dialysis unit, including patient care, scheduling, and quality control.
- Familiarize with the process of conducting dialysis in an ICU setting and understand the specific considerations and challenges involved.
- Learn about peritoneal dialysis as an alternative method and gain proficiency in performing the procedure.
- Explore special and advanced dialysis procedures, such as hemodiafiltration or plasmapheresis, and understand their applications and benefits.
- Demonstrate knowledge and competence in performing cardiopulmonary resuscitation (CPR) techniques, particularly in emergency situations related to dialysis treatment.

Experiment:

- Dialysis Room
- Water treatment plant
- Electronics, Plumbing, Computer
- Management of Dialysis unit
- ICU Side Dialysis
- Peritoneal Dialysis
- Special & advanced dialysis procedures
- CPR Demo

Reference books:

Manual of Nephrology, Robert Schrier Reference books or related websites: Oxford Handbook of Nephrology, 2nd ed.

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

BIOMEDICAL INSTRUMENTATION & DIALYSIS EQUIPMENT PRACTICAL

Subject Code: MDLTS1-206

L T P C

Duration: 60 (Hrs.)

0 0 4 2

Course Objectives:

- To develop a comprehensive understanding of repair techniques and procedures used in machine service and repair, specifically focusing on dialysis machines and associated medical equipment.
- To equip students with the necessary skills to perform fault diagnostics and computer-aided maintenance in dialysis machines, ensuring effective and efficient repair processes.

Course Outcomes:

- Students will be able to apply repair techniques and procedures to diagnose and troubleshoot issues in dialysis machines, demonstrating proficiency in fault diagnostics.
- Students will gain hands-on experience in performing planned preventative maintenance, decalcification, cleaning, disinfection, and infection control measures for dialysis machines and related equipment, emphasizing the importance of patient safety and hygiene.

Experiment-

- Machine Service And Repair: Repair techniques and procedures, Fault diagnostics, Computer aided maintenance Planned preventative maintenance, Hospital / Community, Decalcification, Cleaning Disinfection, Infection control, Dialysis Chairs, Other renal equipment, associated medical equipment.
- Dialysate and dialysate delivery system: preparation, Delivery system – batch type and proportioning type, Drake Willock, Centry, Gambrom, Fresenius etc., Maintenance and trouble shooting, Acetate, Bicarbonate.
- Dailysate supply subsystems: Water pre-treatment – Water pressure regulation – Temperature control – Temperature sensors – Chemical proportioning – Degasing flow and negative pressure control – Monitors. Conductivity cell – chemical concentration monitor – Temperature compensation – Temperature monitors – Pressure monitors – Flow - Rate monitors – Blood leak monitors – Readout devices – Alarms.
- Dialysis machine maintenance: Maintenance / - Repairing and servicing / - Drake-Winlock proportioning unit

Reference books:

1. Dialysis Technology – A Manual for Dialysis Technicians by Jim Curtis, Philip Varughese.
2. Introduction to Biomedical Equipment Technology by Joseph J.Carr, John m. Brown

THIRD SEMESTER

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

NEPHROLOGY & KIDNEY DISEASE

Subject Code: MDLTS1-301

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Objectives:

- To explore recent advances in dialysis and nephrology, including the field of cyber nephrology, and understand their implications in the diagnosis and management of renal diseases.
- To develop a comprehensive understanding of the classification, etiology, pathophysiology, assessment, and management of renal diseases such as acute kidney injury, chronic kidney disease, and various renal disorders.

Course Outcomes:

- Students will be able to analyze and evaluate the recent advances in dialysis and nephrology, including the application of cyber nephrology, and apply this knowledge to enhance the diagnosis and treatment of renal diseases.
- Students will gain a deep understanding of the classification, etiology, pathophysiology, assessment, and management of renal diseases, enabling them to effectively diagnose and manage patients with acute kidney injury, chronic kidney disease, and other renal disorders.

Unit: 1 (12 Hrs)

- Recent Advance in Dialysis and Nephrology
- Cyber Nephrology

Unit: 2 (12 Hrs)

- Basic concepts related to renal failure
- Classification of renal disease –Acute Kidney Injury, Chronic Kidney Disease (Diagnosis, Precaution, Management), Acute Kidney Injury, Classification, Pre renal uremia (Etiology, pathophysiology, assessment, management), Intra-renal uremia (Etiology, pathophysiology, assessment, management, Post renal uremia (Etiology, pathophysiology, assessment, management), Clinical course o AKI, Initiating stage, Oliguric stage, Diuretic stage, Recovery stage

Unit: 3 (12 Hrs)

Chronic Kidney Disease (Includes causes, signs and symptoms, treatment), Developmental/congenital disorder, Cystic disorder, Tubular disorder, Neoplasms, Infectious disease, Glomerulonephritis, Obstructive disorders

Unit: 4 (12 Hrs)

Renal problem and systemic disease, Diabetes mellitus (DM), Diabetes insipidus (DI), Primary hyperparathyroidism, Hepatorenal syndrome, Gout, Amyloidosis, Scleroderma or progressive systemic sclerosis Good pasture syndrome SLE (Systemic lupus Erythromatosis), HUS, Nephrotic syndrome, Hypertensive nephropathy

Unit: 5 (12 Hrs)

Renal problem in pregnancy

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

Reference books:

1. Basics of medical Physiology –D Venkatesh and H.H Sudhakar, 3rd edition.
2. Principles of Physiology – DevasisPramanik, 5th edition.
3. Human Physiology for BDS –Dr A.K. Jain, 5th edition.
4. Textbook of Medical Physiology, Guyton , 2nd South Asia Edition.
5. Textbook of Physiology Volume I & II – Dr. A. K. Jain.
6. Comprehensive textbook of Medical Physiology Volume I & II – Dr. G. K. Pal.

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**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

EMERGENCY MEDICINES

Subject Code: MDLTS1-302

L T P C
3 1 0 4

Duration: 60 (Hrs.)

Course Objectives:

- To provide students with a comprehensive understanding of renal diseases and their epidemiology.
- To develop students' knowledge and skills in managing emergency situations related to renal diseases, including cardiovascular emergencies, electrolyte emergencies, hematologic and gastrointestinal emergencies, as well as complications related to access and problems during and after hemodialysis.

Course Outcomes:

- Students will be able to demonstrate a clear understanding of the epidemiology and major aspects of renal diseases.
- Students will acquire the necessary knowledge and skills to identify and manage emergency situations associated with renal diseases, including cardiovascular emergencies (hyperkalemia, hypermagnesemia, hypocalcemia), electrolyte emergencies (pulmonary edema/volume overload, angina/chest pain, hypertensive emergencies, pericarditis/tamponade), hematologic and gastrointestinal emergencies (anemia and bleeding, metabolic bone disease), and emergencies related to access, problems during and after hemodialysis.

Unit: 1 (15 hrs)

Introduction to emergency: Renal diseases, epidemiology

Unit: 2 (15 hrs)

Cardiovascular Emergencies: Hyperkalemia, Hypermagnesemia, Hypocalcemia

Unit: 3 (15 hrs)

Electrolyte Emergencies: Pulmonary Edema/Volume Overload, Angina/Chest Pain, Hypertensive Emergencies, Pericarditis/Tamponade

Unit: 4 (15 hrs)

- **Hematologic and Gastrointestinal Emergencies:** Anemia and Bleeding, Metabolic Bone Disease
- Emergencies Related to Access, Problems During and After Hemodialysis

Reference books-

1. Essentials of Medical Pharmacology – Tripathi
2. Harrison's Principles of Internal Medicine, 20e
3. Manual of Nephrology, Robert Schrier

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

HEMODIALYSIS

Subject Code: MDLTS1-303

L T P C
3 1 0 4

Duration: 60 (Hrs.)

Course Objectives:

- Understand the protocols and procedures for maintaining and calibrating dialysis equipment, including routine preventative maintenance checks and their frequency.
- Gain knowledge of the principles and processes involved in hemodialysis, including the correct calibration of equipment for the intended activities.

Course Outcomes:

- Demonstrate proficiency in maintaining and calibrating dialysis equipment by following established protocols and conducting routine preventative maintenance checks.
- Apply the principles and processes of hemodialysis to ensure the accurate calibration and proper functioning of equipment for safe and effective treatment.

Unit: 1 (15 hrs)

- Protocol for the equipment to be maintained/calibrated, Routine preventative maintenance checks and their frequency, Correct calibration of equipment for the intended activities.
- Process of Hemodialysis.

Unit: 2 (15 hrs)

- Range of tests and test equipment associated with maintenance and diagnosis of faults on dialysis equipment
- Suitable tests to verify safety, accuracy and operational effectiveness of equipment, including electrical safety

Unit: 3 (15 hrs)

- Principles of operation, function and expected performance, The basis and methods behind electrical safety tests.
- The calibrations and tests to be performed, including calibrating the UF, conductivity, temperature and flow control systems.

Unit: 4 (15 hrs)

- Diagnose routine or common faults in dialysis equipment and relevant corrective action, Use of equipment and PC based diagnostic systems.
- Obtain suitable samples for QA testing using appropriate sampling
- Type and range of samples that is required for QA.

Reference books-

1. John T. Daugirdus, Handbook of Dialysis, 7th ed.
2. Nissonsen, Handbook of Dialysis
3. Henrich, Textbook of Dialysis, 5th ed.

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

PERITONEAL DIALYSIS

Subject Code: MDLTS1-304

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Objectives:

- Understand the principles and process of peritoneal dialysis.
- Familiarize students with the physiological aspects and apparatus of peritoneal dialysis.

Course Outcomes:

- Ability to assess and prescribe peritoneal dialysis for acute and chronic conditions.
- Identify and manage complications associated with peritoneal dialysis.

Unit: 1 (16 hrs)

Introduction to Peritoneal Dialysis, Process of peritoneal dialysis, Advantages and disadvantages of CAPD

Unit: 2 (14 hrs)

Physiology of Peritoneal Dialysis, apparatus of Peritoneal Dialysis, peritoneal access disease.

Unit: 3 (16 hrs)

Acute Peritoneal Dialysis prescription, adequacy of Peritoneal dialysis and chronic peritoneal Dialysis prescription.

Unit: 4 (14 hrs)

- Volume status and fluid overload in Peritoneal Dialysis
- Peritonitis and exit site infections
- Mechanical and metabolic complications of Peritoneal Dialysis

Reference books-

1. Dialysis Technology – A Manual for Dialysis Technicians by Jim Curtis, Philip Varughese.
2. Introduction to Biomedical Equipment Technology by Joseph J.Carr, John m. Brown

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

RENAL TRANSPLANTATION

Subject Code: MDLTS1-305

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Objectives:

- To provide students with a comprehensive overview of renal transplantation, including its history, immunology, and the therapeutic approach for chronic renal failure.
- To familiarize students with the concepts of renal preservation, transplantation, abnormal bladder conditions, histocompatibility, surgical techniques, kidney allocation, pathology, and infection in kidney transplant recipients.

Course Outcomes:

- Students will gain a thorough understanding of the immunological aspects of renal transplantation and the therapeutic options available for treating chronic renal failure.
- Students will be able to explain the surgical techniques involved in renal transplantation, including renal preservation, abnormal bladder conditions, and the importance of histocompatibility in ensuring successful transplantation.
- Students will acquire knowledge of kidney allocation processes, common pathological conditions associated with renal transplantation, and the management of infections in kidney transplant recipients.
- Students will develop an awareness of the ethical and legal considerations related to kidney donation, enhancing their understanding of the broader societal impact of renal transplantation.

Unit -1 (20 hours)

- Renal transplantation: An overview and history
- The immunology of transplantation, Chronic renal failure and renal transplantation therapy

Unit-2 (20 hours)

- Renal preservation, transplantation and abnormal bladder.
- Histocompatibility and surgical techniques of renal transplantation.

Unit-3 (20 Hours)

- Kidney allocation and pathology of renal transplantation
- Infection of kidney transplant recipients
- Ethical and legal aspects of kidney donation

Reference books-

1. Danovitch, Manual of Renal Transplantation, 6th ed.
2. Peter Morris, Renal Transplantation. 9th ed.

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

NEPHROLOGY & KIDNEY DISEASE AND EMERGENCY MEDICINES PRACTICAL

Subject Code: MDLTS1-306

L T P C

Duration: 60 (Hrs.)

0 0 4 2

Course Objectives:

- Understand the importance of laboratory tests in diagnosing and monitoring kidney disease.
- Gain knowledge of emergency procedures and drugs used in the treatment of kidney disease and related conditions.

Course Outcomes:

- Students will be able to interpret blood tests and urine tests to identify indicators of kidney disease.
- Students will be familiar with the different emergency drugs used in emergency medicine and understand their appropriate usage, including in dialysis emergencies.

Experiment-

- Blood tests for kidney disease
- urine tests
- Blood serum
- Ultrasound during kidney disease
- Kidney biopsy
- What is the current research in emergency medicine
- What are the 5 emergency drugs
- Dialysis emergency medicine and their usage

Reference books-

1. Textbook of Medical Physiology, Guyton, 2nd South Asia Edition.
2. Textbook of Physiology Volume I & II – Dr. A. K. Jain.
3. Comprehensive textbook of Medical Physiology Volume I & II – Dr. G. K. Pal.

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

HEMODIALYSIS & DIALYSIS EQUIPMENT PRACTICAL

Subject Code: MDLTS1-307

L T P C

Duration: 60 (Hrs.)

0 0 4 2

Course Objectives:

- To familiarize students with the equipment used during hemodialysis and develop their understanding of its functionality, operation, and maintenance.
- To provide students with a comprehensive understanding of the methods employed in hemodialysis, including the principles, techniques, and procedures involved.

Course Outcomes:

- Upon completion of the course, students will be able to identify and describe the various types of equipment used during hemodialysis, such as dialyzers, dialysis machines, bloodlines, and vascular access devices. They will also demonstrate competence in handling and troubleshooting these equipment effectively.
- By the end of the course, students will be able to explain the different methods employed in hemodialysis, including conventional hemodialysis, hemodiafiltration, and continuous renal replacement therapy. They will have a sound understanding of the underlying principles, indications, contraindications, and potential complications associated with each method.

Experiment-

- Equipment used during hemodialysis
- What are the methods for hemodialysis
- What are the 3 major components of hemodialysis

Reference books-

1. John T. Daugirdus, Handbook of Dialysis, 7th ed.
2. Nisnonsen, Handbook of Dialysis
3. Henrich, Textbook of Dialysis, 5th ed.

**MRSPTU M.SC. (DIALYSIS TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

PERITONIAL DIALYSIS & RENAL TRANSPLANTATION PRACTICAL

Subject Code: MDLTS1-308

L T P C

Duration: 60 (Hrs.)

0 0 4 2

Course Objectives:

- Understand the principles and procedures of peritoneal dialysis, including the peritoneal dialysis test, types of peritoneal dialysis, and the major steps involved in the peritoneal dialysis exchange.
- Gain knowledge about renal transplantation, including the different methods of renal transplantation, the types of kidney transplantation, and the historical significance of the first successful kidney transplantation experiment.

Course Outcomes:

- Students will be able to explain the peritoneal dialysis test, identify the three types of peritoneal dialysis, and describe the three major steps involved in peritoneal dialysis exchange.
- Students will be able to discuss the principles underlying peritoneal dialysis and describe the tests performed for renal transplantation.
- Students will be familiar with the methods of renal transplantation, including the three types of kidney transplantation.
- Students will have knowledge of the first successful kidney transplantation experiment, including the identity of the researcher who performed it and the methodology employed.

Experiment-

- What is the peritoneal dialysis test
- 3 types of peritoneal dialysis
- 3 major steps in peritoneal dialysis exchange
- Which principal is used in peritoneal dialysis
- Tests for renal transplantation
- Methods of renal transplantation
- What are the three types of kidney transplantation
- Who performed the first successful kidney transplantation experiment and how?

Reference books-

1. Danovitch, Manual of Renal Transplantation, 6th ed.
2. Peter Morris, Renal Transplantation. 9th ed.
3. Dialysis Technology – A Manual for Dialysis Technicians by Jim Curtis, Philip Varughese.
4. Introduction to Biomedical Equipment Technology by Joseph J. Carr, John m. Brown