

Ministry of Health and Family Welfare

Allied Health Section 2015-16

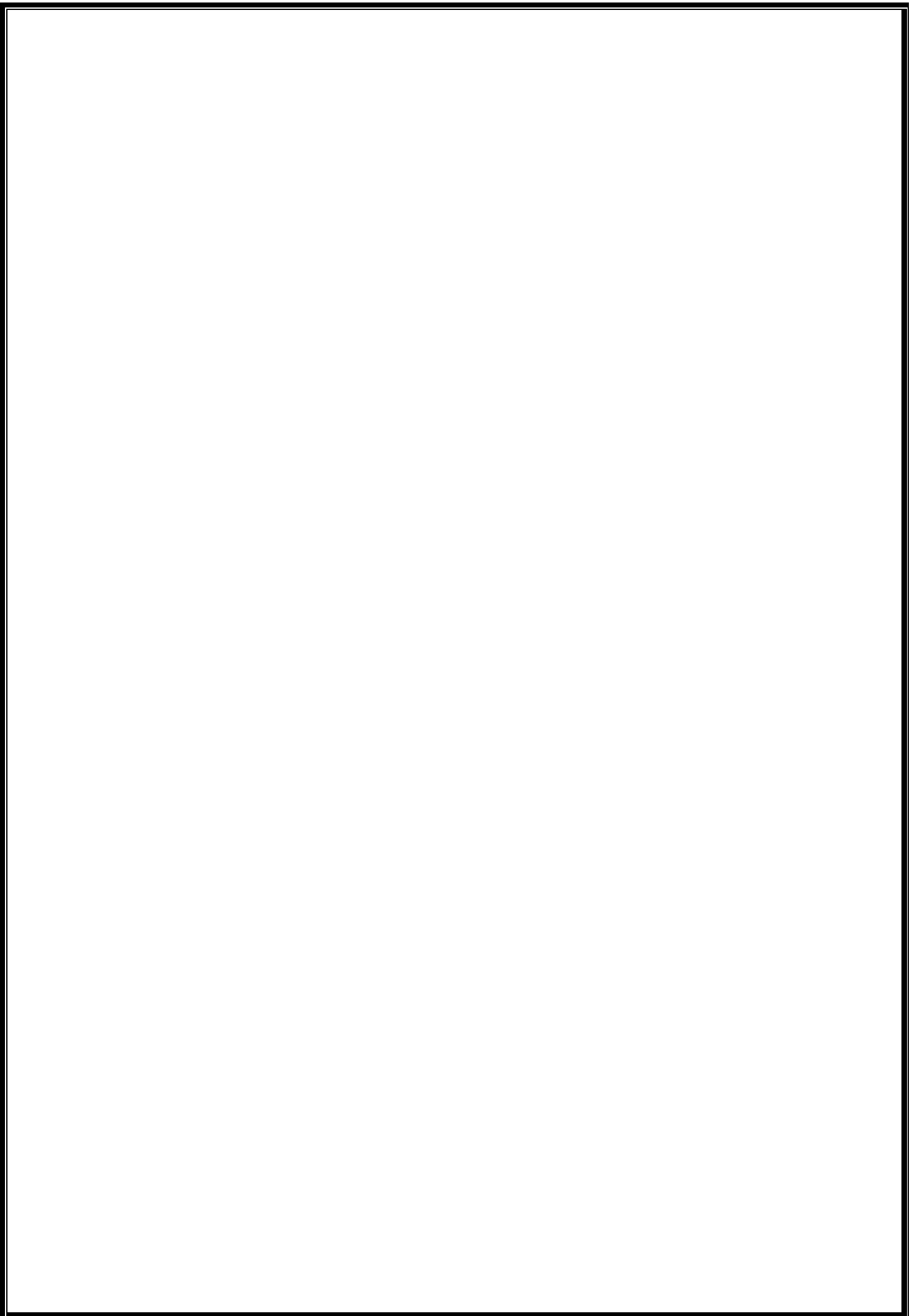


सत्यमेव जयते

Model Curriculum Handbook

DIALYSIS THERAPY TECHNOLOGY





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List of Abbreviations

AC	Alternating Current
ACLS	Advanced Cardiac Life Support
ADH	Anti-Diuretic Hormone
AED	Automated External Defibrillator
AHPs	Allied and Healthcare Professionals
AKI	Acute Kidney Injury
ALS	Advance Life Support
ANCA	Antineutrophil Cytoplasmic Antibody
ANS	Autonomic Nervous System
AntiGBM	Anti–Glomerular Basement Membrane
APD	Automated Peritoneal Dialysis
ARF	Acute/Advanced Renal Failure
ASO/ASLO	Antistreptolysin O
ATN	Acute Tubular Necrosis
ATP	Adenosine Triphosphate
AVF	Arterio-Venous Fistula
AVG	Arterio-Venous Grafts
AYUSH	Ayurveda, Yoga and Naturopathy, Unani, Siddha, Homeopathy
AZA	Azathioprine
B.D.S.	Bachelor of Dental Surgery
B.Sc.	Bachelor of Science
BSc. DTT	Bachelors of Science in Dialysis Therapy Technology
BLD	Blood Leak Detector
BLS	Basic life support
BM	Biomedical
BMR	Basal Metabolic Rate
BMW	Bio Medical Waste
BP	Blood Pressure
BT	Bleeding Time
BUN	Blood Urea Nitrogen
BVMs	Bag Valve Masks
BVSC	Bachelor of Veterinary Science
C-ANCA	Cytoplasmic – Antineutrophil Cytoplasmic Antibody
CAPD	Continuous Ambulatory Peritoneal Dialysis
CATS	Credit Accumulation and Transfer System
CAVH	Continuous Arterio-Venous Hemofiltration
CBCS	Choice-Based Credit System
CBD	Case-based discussion
CCPD	Continuous Cycling Peritoneal Dialysis
CEX	Mini Case Evaluation Exercise
CHC	Community Health Centre
CHF	Congestive Heart Failure
CKD	Chronic Kidney Disease
CMV	Cytomegalovirus

CNS	Central Nervous System
CPR	Cardio Pulmonary Resuscitation
CPU	Central Processing Unit
CRF	Chronic Renal Failure
CRP	C-Reactive Protein
CRRT	Continuous Renal Replacement Therapy
CSA	Cyclosporin A
CSF	Cerebro Spinal Fluid
CT	Clotting Time
DC	Direct Current
DDTT	Diploma in Dialysis Therapy Technology
DGF	Delayed Graft Function
DH	District Hospital
DNA	Deoxyribonucleic Acid
DOPs	Direct observation of procedures
DSA	Donor Specific Antibodies
DTT	Dialysis Therapy Technology
EBV	Epstein-Barr virus
ECG	Electrocardiogram
ECTS	European Credit Transfer System
EEG	Electroencephalogram
ELISA	Enzyme-Linked Immuno Sorbent Assay
EMG	Electromyogram
EMR	Electronic Medical Records
EMS	Emergency Medical Services
EPROM	Erasable Programmable Read Only Memory
ESR	Erythrocyte Sedimentation Rate
ESRD	End Stage Renal Disease
FISH	Fluorescence In Situ Hybridization
G	Gravity
GFR	Glomerular Filtration Rate
GIT	Gastro-Intestinal Tract
H & E Staining	Hematoxylin and Eosin Staining
Hb	Hemoglobin
HBsAg	Hepatitis B Surface Antigen (or protein)
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV	Human immunodeficiency virus
HLA	Human Leukocyte Antigen
HLS	Histocompatibility
HoD	Head of Department
HRQOL	Health-Related Quality Of Life
HSSC	Healthcare Sector Skill Council
ICT	Information and Communications Technology
ICU	Intensive Care Unit

IgA	Immunoglobulin A
IgD	Immunoglobulin D
IgE	Immunoglobulin E
IgG	Immunoglobulin G
IgM	Immunoglobulin M
ILO	International Labour Organization
ISCN	International System for Human Cytogenetic Nomenclature
ISO	International Organization for Standardization
IV	Intravenous
IVP	Intra Venous Pyelogram
JCI	Joint Commission International
JD	Job description
JG	Juxtaglomerular
K	Clearance
KoA	Mass Transfer Coefficient
KT/V	Number used to quantify hemodialysis and peritoneal dialysis treatment adequacy, where K - dialyzer clearance of urea, t - dialysis time and V - volume of distribution of urea, approximately equal to patient's total body water
Kuf	Ultrafiltration Coefficient
L J media	Löwenstein–Jensen medium
L.S.	Longitudinal Section
LAN	Local Area Network
LD	Level Detector
LF	Lactose Fermenting
LMWH	Low Molecular Weight Heparin
LS	Longitudinal Section
M.B.B.S.	Bachelor of Medicine and Bachelor of Surgery
M.Sc.	Master of Science
M.Sc.DTT	Master of Science in Dialysis Therapy Technology
MAb	Monoclonal Antibody
MAN	Metropolitan area network
MARS	Molecular Adsorbent Recirculating System
MCH	Mean Cell Haemoglobin
MCHC	Mean Corpuscular Hemoglobin Concentration
MCV	Mean Cell (or Corpuscular) Volume
ME	Microscopic Examination
MHC	Major Histocompatibility Complex
MLC	Medico legal case
MoHFW	Ministry of Health and Family Welfare
MoU	Memorandum of Understanding
MS	Microsoft
NA	Nutrient Agar
NAAC	National Assessment and Accreditation Council
NABH	National Accreditation Board for Hospitals & Healthcare Providers
NBAHS	National Board of Allied and Healthcare Sciences
NCRC	National Curricula Review Committee

NHM	National Health Mission
NHP	National Health Programme
NIAHS TSU	National Initiative for Allied Health Sciences-Technical Support Unit
NIPD	Nocturnal Intermittent Peritoneal Dialysis
NK cell	Natural Killer cell
NLF	Non Lactose Fermenting
NMJ	Neuromuscular Junction
NSDA	National Skills Development Agency
NSQF	National Skills Qualification Framework
OSCE	Objective Structured Clinical Examination
OSLER	Objective Structured Long Examination Record
OSPE	Objective Structured Practical Examination
OT	Operation Theatre
P-ANCA	Perinuclear – Antineutrophil Cytoplasmic Antibody
PAOP	Pulmonary Artery Occlusion Pressure
PCM/B	Physics, Chemistry, Maths/ Biology
PCR	Polymerase Chain Reaction
PCTs	Patient Care Technologists
PCV	Packed Cell Volume
PD	Peritoneal Dialysis
PEA	Pulseless Electrical Activity
PET	Peritoneal Equilibrium/Equilibration Test
PG	Post Graduate
Ph.D.	Doctor of Philosophy
PHC	Primary Health Centre
POSSOM	Pictures of Standard Syndromes and Undiagnosed Malformations
PPE	Personal Protective Equipment
PRA	Panel Reactive Antibodies
PT	Prothrombin Time
PTH	Para-Thyroid Hormone
PTT	Partial Thromboplastin Time
RAM	Random Access Memory
RBC	Red Blood Cells
RDA	Recommended Dietary Allowances
RF	Rheumatoid Factor
RNA	Ribonucleic Acid
RO	Reverse Osmosis
ROM	Read-Only Memory
RPM	Revolutions Per Minute
RQ	Respiratory Quotient
RS	Respiratory System
SC/ST/OBC	Schedules Castes/ Scheduled Tribes/ Other Backward Classes
SCA	Sudden Cardiac Arrest
SCUF	Slow Continuous Ultrafiltration
SDA	Specific Dynamic Action

SDH	Sub District Hospital
SDL	self-directed learning
SI	System International
SLED	Slow Low Efficiency Dialysis/Sustained Low-Efficiency Dialysis
T.S.	Transverse Section
TIBC	Total Iron Binding Capacity
TmG	Transport maximum for Glucose
TMP	Trans Membrane Pressure
TNF	Tumor Necrosis Factor
TS	Transverse Section
TSC	Technical safety checks
UF	Ultrafiltration
UGC	University Grants Commission
UHC	Universal Health Care
UTI	Urinary Tract Infection
UV	Ultra-Violet
VDE test	Verband der Elektrotechnik
VDRL	Venereal Disease Research Laboratory
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia
WAN	Wide area network
WBC	White Blood Cells
WWW	World Wide Web

Chapter 1

Introduction to the Handbook

Chapter 1: Introduction to the Handbook

The report ‘From Paramedics to Allied Health Professionals: Landscaping the Journey and Way Forward’ that was published in 2012, marked the variance in education and training practices for the allied and healthcare courses offered by institutions across the country. This prompted the Ministry of Health and Family Welfare to envisage the creation of national guidelines for education and career pathways of allied and healthcare professionals, with a structured curriculum based on skills and competencies. Thus, this handbook has been designed to familiarize universities, colleges, healthcare providers as well as educators offering allied and healthcare courses with these national standards.

Individually, created for different professional groups of allied and healthcare, this handbook aims to reduce the variation in education by comprising of a standardized curriculum, career pathways, nomenclature and other details for each profession. The change from a purely didactic approach will create better skilled professionals and improve the quality of overall patient care. In the absence of a national standard-setting authority, this handbook can also guide the thousands of young adults who choose healthcare as a profession – not as doctors or nurses but to play several other critical roles – on the appropriate course of action to enable them to be skilled allied and healthcare professionals of the future.

Who is an Allied and Healthcare Professional?

The Ministry of Health and Family Welfare, accepted in its entirety the definition of an allied and healthcare professional based on the afore-mentioned report, though the same has evolved after multiple consultations and the recommended definition is now as follows-

‘Allied and healthcare professionals (AHPs) includes individuals involved with the delivery of health or healthcare related services, with qualification and competence in therapeutic, diagnostic, curative, preventive and/or rehabilitative interventions. They work in multidisciplinary health teams in varied healthcare settings including doctors (physicians and specialist), nurses and public health officials to promote, protect, treat and/or manage a person(s) physical, mental, social, emotional, environmental health and holistic well-being.’⁴

Since the past few years, many professional groups have been interacting and seeking guidance on all those who would qualify under the purview of “allied and healthcare professionals”. In the healthcare system, statutory bodies exist for clinicians, nurses, pharmacists and dental practitioners; but a regulatory structure for around 50 professions is absent in India. Currently, the Government is considering these professions (as listed Annex-1) under the ambit of the allied and healthcare system. However, this number is subject to changes and modifications over time, particularly considering how quickly new technologies and new clinical avenues are expanding globally, creating newer cadres of such professionals.

Scope and need for allied and healthcare professionals in the Indian healthcare system

The quality of medical care has improved tremendously in the last few decades due to the advances in technology, thus creating fresh challenges in the field of healthcare. It is now widely recognized that health service delivery is a team effort involving both clinicians and non-clinicians, and is not the sole duty of physicians and nurses.¹ Professionals that can competently handle sophisticated

machinery and advanced protocols are now in high demand. In fact, diagnosis is now so dependent on technology, that allied and healthcare professionals (AHPs) are vital to successful treatment delivery.

Effective delivery of healthcare services depends largely on the nature of education, training and appropriate orientation towards community health of all categories of health personnel, and their capacity to function as an integrated team. For instance in the UK, more than 84,000 AHPs, with a range of skills and expertise, play key roles within the National Health Service, working autonomously, in multi-professional teams in various settings. All of them are first-contact practitioners and work across a wide range of locations and sectors within acute, primary and community care. Australia's health system is managed not just by their doctors and nurses, but also by the 90,000 university-trained, autonomous AHPs vital to the system.^{2,3}

As the Indian government aims for Universal Health Coverage, the lack of skilled human resource may prove to be the biggest impediment in its path to achieve targeted goals. The benefits of having AHPs in the healthcare system are still unexplored in India. Although an enormous amount of evidence suggests that the benefits of AHPs range from improving access to healthcare services to significant reduction in the cost of care, though the Indian healthcare system still revolves around the doctor-centric approach. The privatization of healthcare has also led to an ever-increasing out-of-pocket expenditure by the population. However, many examples assert the need of skilled allied and healthcare professionals in the system, such as in the case of stroke survivors, it is the support of AHPs that significantly enhance their rehabilitation and long term treatment ensures return to normal life. AHPs also play a significant role to care for patients who struggle mentally and emotionally in the current challenging environment and require mental health support; and help them return to well-being.² Children with communication difficulties, the elderly, cancer patients, patients with long term conditions such as diabetes people with vision problems and amputees; the list of people and potential patients who benefit from AHPs is indefinite.

Thus, the breadth and scope of the allied and healthcare practice varies from one end to another, including areas of work listed below:

- Across the age span of human development from neonate to old age;
- With patients having complex and challenging problems resulting from systemic illnesses such as in the case of diabetes, cardiac abnormalities/conditions and elderly care to name a few;
- Towards health promotion and disease prevention, as well as assessment, management and evaluation of interventions and protocols for treatment;
- In a broad range of settings from a patient's home to community, primary care centers, to tertiary care settings; and
- With an understanding of the healthcare issues associated with diverse socio-economies and cultural norms within the society.

Learning goals and objectives for allied and healthcare professionals

The handbook has been designed with a focus on performance-based outcomes pertaining to different levels. The learning goals and objectives of the undergraduate and graduate education program will be based on the performance expectations. They will be articulated as learning goals

(why we teach this) and learning objectives (what the students will learn). Using the framework, students will learn to integrate their knowledge, skills and abilities in a hands-on manner in a professional healthcare setting. These learning goals are divided into nine key areas, though the degree of required involvement may differ across various levels of qualification and professional cadres:

1. Clinical care
2. Communication
3. Membership of a multidisciplinary health team
4. Ethics and accountability at all levels (clinical, professional, personal and social)
5. Commitment to professional excellence
6. Leadership and mentorship
7. Social accountability and responsibility
8. Scientific attitude and scholarship (only at higher level- PhD)
9. Lifelong learning

1. Clinical Care⁴

Using a patient/family-centered approach and best evidence, each student will organize and implement the prescribed preventive, investigative and management plans; and will offer appropriate follow-up services. Program objectives should enable the students to:

- Apply the principles of basic science and evidence-based practice
- Use relevant investigations as needed
- Identify the indications for basic procedures and perform them in an appropriate manner
- Provide care to patients – efficiently and in a cost-effective way – in a range of settings, and maintain foremost the interests of individual patients
- Identify the influence of biological, psychosocial, economic, and spiritual factors on patients' well-being and act in an appropriate manner
- Incorporate strategies for health promotion and disease prevention with their patients

2. Communication^{4,5}

The student will learn how to communicate with patients/clients, care-givers, other health professionals and other members of the community effectively and appropriately. Communication is a fundamental requirement in the provision of health care services. Program objectives should enable the students to:

- Provide sufficient information to ensure that the patient/client can participate as actively as possible and respond appropriately to the information
- Clearly discuss the diagnosis and options with the patient, and negotiate appropriate treatment plans in a sensitive manner that is in the patient's and society's best interests
- Explain the proposed healthcare service – its nature, purpose, possible positive and adverse consequences, its limitations, and reasonable alternatives wherever they exist
- Use effective communication skills to gather data and share information including attentive listening, open-ended inquiry, empathy and clarification to ensure understanding

- Appropriately communicate with, and provide relevant information to, other stakeholders including members of the healthcare team
- Use communication effectively and flexibly in a manner that is appropriate for the reader or listener
- Explore and consider the influence that the patient's ideas, beliefs and expectations have during interactions with them, along with varying factors such as age, ethnicity, culture and socioeconomic background
- Develop efficient techniques for all forms of written and verbal communication including accurate and timely record keeping
- Assess their own communication skills, develop self-awareness and be able to improve their relationships with others
- Possess skills to counsel for lifestyle changes and advocate health promotion

3. Membership of a multidisciplinary health team⁶

The student will put a high value on effective communication within the team, including transparency about aims, decisions, uncertainty and mistakes. Team-based health care is the provision of health services to individuals, families, and/or their communities by at least two health providers who work collaboratively to accomplish shared goals within and across settings to achieve coordinated, high quality care. Program objectives will aim at making the students being able to:

- Recognize, clearly articulate, understand and support shared goals in the team that reflect patient and family priorities
- Possess distinct roles within the team; to have clear expectations for each member's functions, responsibilities, and accountabilities, which in turn optimizes the team's efficiency and makes it possible for them to use division of labor advantageously, and accomplish more than the sum of its parts
- Develop mutual trust within the team to create strong norms of reciprocity and greater opportunities for shared achievement
- Communicate effectively so that the team prioritizes and continuously refines its communication channels creating an environment of general and specific understanding
- Recognize measurable processes and outcomes, so that the individual and team can agree on and implement reliable and timely feedback on successes and failures in both the team's functioning and the achievement of their goals. These can then be used to track and improve performance immediately and over time.

4. Ethics and accountability

Students will understand core concepts of clinical ethics and law so that they may apply these to their practice as healthcare service providers. Program objectives should enable the students to:

- Describe and apply the basic concepts of clinical ethics to actual cases and situations
- Recognize the need to make health care resources available to patients fairly, equitably and without bias, discrimination or undue influence
- Demonstrate an understanding and application of basic legal concepts to the practice
- Employ professional accountability for the initiation, maintenance and termination of patient-provider relationships

- Demonstrate respect for each patient's individual rights of autonomy, privacy, and confidentiality

5. Commitment to professional excellence⁷

The student will execute professionalism to reflect in his/her thought and action a range of attributes and characteristics that include technical competence, appearance, image, confidence level, empathy, compassion, understanding, patience, manners, verbal and non-verbal communication, an anti-discriminatory and non-judgmental attitude, and appropriate physical contact to ensure safe, effective and expected delivery of healthcare. Program objectives will aim at making the students being able to:

- Demonstrate distinctive, meritorious and high quality practice that leads to excellence and that depicts commitment to competence, standards, ethical principles and values, within the legal boundaries of practice
- Demonstrate the quality of being answerable for all actions and omissions to all, including service users, peers, employers, standard-setting/regulatory bodies or oneself
- Demonstrate humanity in the course of everyday practice by virtue of having respect (and dignity), compassion, empathy, honour and integrity
- Ensure that self-interest does not influence actions or omissions, and demonstrate regards for service-users and colleagues

6. Leadership and mentorship⁸

The student must take on a leadership role where needed in order to ensure clinical productivity and patient satisfaction. They must be able to respond in an autonomous and confident manner to planned and uncertain situations, and should be able to manage themselves and others effectively. They must create and maximize opportunities for the improvement of the health seeking experience and delivery of healthcare services. Program objectives should enable the students to:

- Act as agents of change and be leaders in quality improvement and service development, so that they contribute and enhance people's wellbeing and their healthcare experience
- Systematically evaluate care; ensure the use of these findings to help improve people's experience and care outcomes, and to shape clinical treatment protocols and services
- Identify priorities and effectively manage time and resources to ensure the maintenance or enhancement of the quality of care
- Recognize and be self-aware of the effect their own values, principles and assumptions may have on their practice. They must take charge of their own personal and professional development and should learn from experience (through supervision, feedback, reflection and evaluation)
- Facilitate themselves and others in the development of their competence, by using a range of professional and personal development skills
- Work independently and in teams. They must be able to take a leadership role to coordinate, delegate and supervise care safely, manage risk and remain accountable for the care given; actively involve and respect others' contributions to integrated person-centered care; yet work in an effective manner across professional and agency

boundaries. They must know when and how to communicate with patients and refer them to other professionals and agencies, to respect the choices of service users and others, to promote shared decision-making, to deliver positive outcomes, and to coordinate smooth and effective transition within and between services and agencies.

7. Social Accountability and Responsibility⁹

The students will recognize that allied and healthcare professionals need to be advocates within the health care system, to judiciously manage resources and to acknowledge their social accountability.¹⁰ They have a mandate to serve the community, region and the nation and will hence direct all research and service activities towards addressing their priority health concerns. Program objectives should enable the students to:

- Demonstrate knowledge of the determinants of health at local, regional and national levels and respond to the population needs
- Establish and promote innovative practice patterns by providing evidence-based care and testing new models of practice that will translate the results of research into practice, and thus meet individual and community needs in a more effective manner
- Develop a shared vision of an evolving and sustainable health care system for the future by working in collaboration with and reinforcing partnerships with other stakeholders, including academic health centres, governments, communities and other relevant professional and non-professional organizations
- Advocate for the services and resources needed for optimal patient care

8. Scientific attitude and Scholarship¹⁰

The student will utilize sound scientific and/or scholarly principles during interactions with patients and peers, educational endeavors, research activities and in all other aspects of their professional lives. Program objectives should enable the students to:

- Engage in ongoing self-assessment and structure their continuing professional education to address the specific needs of the population
- Practice evidence-based by applying principles of scientific methods
- Take responsibility for their educational experiences
- Acquire basic skills such as presentation skills, giving feedback, patient education and the design and dissemination of research knowledge; for their application to teaching encounters

9. Lifelong learning¹¹

The student should be committed to continuous improvement in skills and knowledge while harnessing modern tools and technology. Program objectives will aim at making the students being able to:

- Perform objective self-assessments of their knowledge and skills; learn and refine existing skills; and acquire new skills
- Apply newly gained knowledge or skills to patient care
- Enhance their personal and professional growth and learning by constant introspection and utilizing experiences

- Search (including through electronic means), and critically evaluate medical literature to enable its application to patient care
- Develop a research question and be familiar with basic, clinical and translational research in its application to patient care
- Identify and select an appropriate, professionally rewarding and personally fulfilling career pathway

Introduction of new elements in allied and healthcare education

Competency-based curriculum

A significant skill gap has been observed in the professionals offering healthcare services irrespective of the hierarchy and level of responsibility in the healthcare settings. The large variation in the quality of services is due to the diverse methodologies opted for healthcare education and the difference in expectations from a graduate after completion of a course and at work. What one is expected 'to perform' at work is assumed to be learned during the course, however, the course design focuses on what one is expected 'to know'. The competency-based curriculum thus connects the dots between the 'know what' and 'do how'.

The efficiency and effectiveness of any educational programme largely depends on the curriculum design that is being followed. With emerging medical and scientific knowledge, educators have realized that learning is no more limited to memorizing specific lists of facts and data; in fact, by the time the professional aims to practice in the healthcare setting, the acquired knowledge may stand outdated. Thus, competency-based education is the answer; a curricular concept designed to provide the skills that professionals need. A competency-based program is a mix of skills and competencies based on individual or population needs (such as clinical knowledge, patient care, or communications approaches), which is then developed to teach relevant content across a range of courses and settings. While the traditional system of education focuses on objectives, content, teacher-centric approach and summative evaluation; competency-based education has a focus on competencies, outcomes, performance and accomplishments. In such a case, teaching activities are learner-centered, and evaluation is continuous and formative in structure. The competency-based credentials depend on the demonstration of a defined set of competencies which enables a professional to achieve targeted goals. Competency frameworks comprise of a clearly articulated statement of a person's abilities on the completion of the credential, which allows students, employers, and other stakeholders to set their expectations appropriately.^{12 13}

Considering the need of the present and future healthcare delivery system, the curriculum design depicted in this handbook thus will be based on skills and competencies.

Promoting self-directed learning of the professionals

The shift in the focus from traditional to competency-based education has made it pertinent that the learning processes may also be revisited for suitable changes. It is a known fact that learning is no more restricted to the boundaries of a classroom or the lessons taught by a teacher. The new tools and technologies have widened the platform and introduced innovative modes of how students can learn and gain skills and knowledge. One of the innovative approaches is learner-centric and follows the concept of **self-directed learning**.

Self-directed learning, in its broadest meaning, describes a process in which individuals take the initiative with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying resources for learning, choosing and implementing learning strategies and evaluating learning outcomes (Knowles, 1975).¹⁴

In self-directed learning, learners themselves take the initiative to use resources rather than simply reacting to transmissions from resources, which helps them learn more in a better way.¹⁵ Lifelong, self-directed learning (SDL) has been identified as an important ability for medical graduates

(Harvey, 2003)¹⁶ and so is applicable to other health professionals including AHPs. It has been proven through many studies worldwide that the self-directed method is better than the teacher-centric method of learning. Teacher-directed learning makes learners more dependent and the orientation to learning becomes subject-centered. If a teacher provides the learning material, the student is usually satisfied with the available material, whereas if a student is asked to work on the same assignment, he or she invariably has to explore extensive resources on the subject.¹⁵

Thus the handbook promotes self-directed learning, apart from the usual classroom teaching and opens the platform for students who wish to engage in lifelong learning.

Credit hours vs traditional system

Recently the National Assessment and Accreditation Council (NAAC) and the University Grants Commission (UGC) have highlighted the need for the development of a Choice-Based Credit System (CBCS), at par with global standards and the adoption of an effective grading system to measure a learner's performance.¹⁷ All the major higher education providers across the globe are operating a system of credits. The European Credit Transfer System (ECTS), the 'National Qualifications Framework' in Australia, the Pan-Canadian Protocol on the Transferability of University Credits, the Credit Accumulation and Transfer System (CATS) in the UK as well as the systems operating in the US, Japan, etc. are examples of these. Globally, a need now exists for the use of a fully convertible credit-based system that can be accepted at other universities. It has now become imperative to offer flexible curricular choices and provide learners mobility due to the popularity of initiatives such as 'twinning programmes', 'joint degrees' and 'study abroad' programmes.¹⁸

In order to ensure global acceptability of the graduates, the current curriculum structure is divided into smaller sections with focus on hours of studying which can be converted into credit hours as per the international norms followed by various other countries.

Integrated structure of the curriculum

Vertical integration, in its truest sense, is the interweaving of teaching clinical skills and knowledge into the basic science years and, reinforcing and continuing to teach the applications of basic science concepts during the clinical years. (Many efforts called 'vertical integration' include only the first half of the process).

Horizontal integration is the identification of concepts or skills, especially those that are clinically relevant, that cut across (for example, the basic sciences), and then putting these to use as an integrated focus for presentations, clinical examples, and course materials. e.g. Integration of some of the basic science courses around organ systems, e.g., human anatomy, physiology, pathology; or incorporating ethics, legal issues, finance, political issues, humanities, culture and computer skills into different aspects of a course like the Clinical Continuum.

The aim of an integrated curriculum is to lead students to a level of scientific fluency that is beyond mere fact and concept acquisition, by the use of a common language of medical science, with which they can begin to think creatively about medical problems.¹⁹

This innovative new curriculum has been structured in a way such that it facilitates horizontal and vertical integration between disciplines; and bridges the gaps between both theory & practice, and

between hospital-based practice and community practice. The amount of time devoted to basic and laboratory sciences (integrated with their clinical relevance) would be the maximum in the first year, progressively decreasing in the second and third year of the training, making clinical exposure and learning more dominant.¹¹ However it may differ from course to course depending on the professional group.

Introduction of foundation course in the curriculum

The foundation course for allied and healthcare professions is an immersive programme designed to impart the required knowledge, skills and confidence for seamless transition to the second semester of a professional allied and healthcare course. Post admission, the foundation course is designed for a period of 6 months to prepare a student to study the respective allied and healthcare course effectively and to understand the basics of healthcare system. This aims to orient the student to national health systems and the basics of public health, medical ethics, medical terminologies, communication skills, basic life support, computer learning, infection prevention and control, environmental issues and disaster management, as well as orientation to the community with focus on issues such as gender sensitivity, disability, human rights, civil rights etc. Though the flexibility to the course designers have been provided in terms of – modifying the required numbers of hours for each foundation subject and appropriate placement of the subject across various semesters.

Learning methodologies

With a focus on self-directed learning, the curriculum will include a foundation course that focuses on communication, basic clinical skills and professionalism; and will incorporate clinical training from the first year itself. It is recommended that the primary care level should have sufficient clinical exposure integrated with the learning of basic and laboratory sciences. There should also be an emphasis on the introduction of case scenarios for classroom discussion/case-based learning.

Healthcare education and training is the backbone of an efficient healthcare system and India's education infrastructure is yet to gain from the ongoing international technological revolution. The report '*From Paramedics to Allied Health: Landscaping the Journey and way ahead*', indicates that teaching and learning of clinical skills occur at the patient's bedside or other clinical areas such as laboratories, augmented by didactic teaching in classrooms and lecture theatres. In addition to keeping up with the pace of technological advancement, there has been a paradigm shift to outcome-based education with the adoption of effective assessment patterns. However, the demand for demonstration of competence in institutions where it is currently limited needs to be promoted. The report also mentions some of the allied and healthcare schools in India that have instituted clinical skill centres, laboratories and high-fidelity simulation laboratories to enhance the practice and training for allied and healthcare students and professionals. The report reiterates the fact that simulation is the replication of part or all of a clinical encounter through the use of mannequins, computer-assisted resources and simulated patients. The use of simulators addresses many issues such as suboptimal use of resources and equipment, by adequately training the manpower on newer technologies, limitations for imparting practical training in real-life scenarios, and ineffective skills assessment methods among others.¹ The table mentioned below lists various modes of teaching and learning opportunities that harness advanced tools and technologies.

Table 1 Clinical learning opportunities imparted through the use of advanced techniques^{1,20}

Teaching modality	Learning opportunity examples
Patients	Teach and assess in selected clinical scenarios
	Practice soft skills
	Practice physical examination
	Receive feedback on performance
Mannequins	Perform acquired techniques
	Practice basic procedural skills
	Apply basic science understanding to clinical problem solving
Simulators	Practice teamwork and leadership
	Perform cardiac and pulmonary care skills
	Apply basic science understanding to clinical problem solving
Task under trainers	Monitor and terminate dialysis treatment, etc.

Assessment methods

Traditional assessment of students consists of the yearly system of assessments. In most institutions, assessments consist of internal and external assessments, and a theory examination at the end of the year or semester. This basically assesses knowledge instead of assessing skills or competencies. In competency-based training, the evaluation of the students is based on the performance of the skills as per their competencies. Hence, all the three attributes – knowledge, skills, and attitudes – are assessed as required for the particular competency.

Several new methods and tools are now readily accessible, the use of which requires special training. Some of these are given below:

- Objective Structured Clinical Examination(OSCE), Objective Structured Practical Examination (OSPE), Objective Structured Long Examination Record(OSLER)
- Mini Case Evaluation Exercise(CEX)
- Case-based discussion(CBD)
- Direct observation of procedures(DOPs)
- Portfolio
- Multi-source feedback
- Patient satisfaction questionnaire

An objective structured clinical examination (OSCE) is used these days in a number of allied and healthcare courses, e.g. Optometry, Physiotherapy, and Radiography. It tests the performance and competence in communication, clinical examination, and medical procedures/prescriptions. In physiotherapy, orthotics, and occupational therapy, it tests exercise prescription, joint mobilization/manipulation techniques; and in radiography it tests radiographic positioning, radiographic image evaluation, and interpretation of results. The basic essential elements consist of functional analysis of the occupational roles, translation of these roles (“competencies”) into outcomes, and assessment of trainees' progress in these outcomes on the basis of demonstrated

performance. Progress is defined solely by the competencies achieved and not the underlying processes or time served in formal educational settings. Most methods use predetermined, agreed assessment criteria (such as observation check-lists or rating scales for scoring) to emphasize on frequent assessment of learning outcomes. Hence, it is imperative for teachers to be aware of these developments and they should suitably adopt them in the allied and healthcare education system.²¹

Chapter 2

Methodology of Curriculum Development

Chapter 2: Methodology of curriculum development

With the release of the report ‘From Paramedics to Allied Health: Landscaping the journey and the way ahead’, the Ministry of Health and Family Welfare prioritized the key recommendations and concerns raised by various allied and healthcare professionals groups and experts as indicated in the report. One of the major recommendations in the report was the need for standardization of curriculum and pedagogic requirements for the major allied and healthcare professional courses.

The MoHFW has identified 12 priority professional streams in the phase-I for the purpose of standardization. The expertise of over 50 leading public and private allied and healthcare educational institutions for 12 different disciplines has been sought as part of this exercise. Additionally, international experts from Canada, Sweden, USA and UK are also being roped in, to arrive at a comprehensive and globally acceptable set of educational standards based on a skills and competencies approach. The opinions were sought from experts for all the courses, though curricula for the following two professions were not redesigned as they fall under the ambit of regulatory body- Rehabilitation Council of India governed by Ministry of Social Justice and Empowerment –

- Audiology and Speech Pathology
- Orthotics and Prosthetics

The National Skills Development Agency has also developed the National Skills Qualification Framework (NSQF). Under the aegis of the NSDA, the Healthcare Sector Skill Council (HSSC) has undertaken a similar process for a few entry level allied and healthcare courses (Certificate and Diploma level). The focus of Ministry of Health and Family Welfare is thus to preempt duplication of efforts and arrive at a comprehensive set of minimum standards for the allied and healthcare professions but for higher level professional qualifications. This would ensure that the key considerations and obligations of both the public and the private sector are adequately addressed.

In view of the above, the Ministry of Health and Family Welfare instituted 12 National Curricula Redesign Taskforce groups comprising of academicians and professionals from the best institutes and colleges across the country. These people served as subject experts and redesigned the curricula based on a standardized framework developed by the NIAHS TSU (National Initiative for Allied Health Sciences-Technical Support Unit), which is the technical arm supporting this project. The final curriculum has been reviewed and approved by the National Curricula Review Committee (NCRC), (constituted by the MoHFW), that consists of experts with versatile and immense experience in their respective streams, to assess the applicability of the curricula drafted in view of the healthcare system as a whole.

Steps undertaken in the curricula review process –

1. Curricula were sought from various States and institutions across the country in response to which the NIAHS TSU reviewed–
 - a. 118 curricula of allied and healthcare courses (different levels and different professions) from 10 states across the country;
 - b. 133 curricula of various allied and healthcare courses collected during phase-I of the NIAHS project.

2. Literature review – a comprehensive literature review was undertaken resulting in a detailed curriculum of the allied and healthcare courses, which included competency and skills-based models followed nationally as well as internationally, methodologies of curriculum development, assessment protocols, and many such aspects of curriculum development. The literature review helped the TSU to develop a reference document that comprised of a standard framework for a competency-based curriculum to be followed for the curricula review and redesign. A detailed mapping of all the resources was undertaken and shared with the taskgroup experts via email.
3. Constitution of the National Curricula Redesign Taskforces for various professional groups – Specific taskforces were then instituted comprising of technical as well as subject experts who were engaged in the process of redesigning the curriculum.
4. Constitution of the National Curricula Review Committee (NCRC) – The NCRC comprising of experts with versatile and immense experiences of their respective domain, was then constituted for final review and approval on the curriculum drafted by the taskforce and NIAHS TSU.
5. National Curricula Redesign Taskforce Consultations– a series of consultations were conducted with subject experts including both regional and national taskgroup experts to develop a ‘skill and competency’ framework for education and career pathways. The consultations were facilitated by the NIAHS TSU members and were led by the chairperson of the group. Post this, the draft version and recommendations were compiled by the TSU members and sent to the experts for final review and consent.
6. Local consultations – These were also conducted in different hospitals and other healthcare settings to get suggestions, feedbacks and ideas from the subject experts for their respective curricula.
7. Response draft – Comments and suggestions were received on the draft and a response draft curriculum was prepared, which was then re-circulated for final consent and validation by the taskgroup experts.
8. Submission and approval of draft curriculum – The final draft of the curriculum handbook was then submitted by the taskforce chairman to the National Curricula Review Committee for approval and final sign-off.
9. Public opinion – The handbook was uploaded to seek public opinion from national and international experts, students, faculty, and practitioners of the respective professional groups.
10. Final approval by the NCRC- The comments and suggestions by the public were then reviewed and considered for any possible modification by the taskforce group. The final approval and sign off for the overall structure was then sought from NCRC.
11. Dissemination- The final handbook (guidelines) is disseminated by the Ministry of Health and Family Welfare for further adoption and incorporation by institutes/universities as applicable to ensure standardization.

Chapter 3

Background of the profession

Chapter 3: Background of the profession

Statement of Philosophy– Why this profession holds so much importance?

Historically, dialysis treatment has been viewed as a life-sustaining therapy that aims to extend survival and improve the quality of life. However, the rigors of dialysis treatment, psychosocial and vocational adjustments, loss of independence and functional status, and metabolic derangements as a result of kidney disease are now significant contributors to the decrease in health-related quality of life (HRQOL).

Patients with limited health literacy – the ability to obtain, process, and understand health information in order to make appropriate health decisions – may not fully understand written medical information, may not be able to communicate effectively with healthcare providers, or navigate the increasingly complex healthcare system. Studies suggest that limited health literacy may negatively affect patients' wellbeing and increase healthcare costs. Health literacy is particularly important for kidney patients undergoing dialysis. They must attend treatment sessions several days a week, follow dietary and fluid restrictions, and adhere to complex medication regimens, all of which require patients to understand and act on complicated health-related information.^{22,23,24,25,26}

About Dialysis Therapy Technology

Dialysis is intended to keep the body running as normal as possible while the kidneys are under repair or while a person waits for a kidney transplant. Without working kidneys or dialysis, salts and other waste products would accumulate in the blood and poison the person. Typical haemodialysis treatments (using an artificial kidney) last about four hours and are needed about three times a week.²³

Scope of practice

Dialysis Assistants work with the Dialysis Therapy Technologist to plan implementation of the dialysis prescription, perform hemodialysis, manage various intra-dialytic complications and document patient data.

The Dialysis Therapy Technologist works with the Head of Department/ Senior Dialysis Therapy Technologist to supervise the hemodialysis assistants and auxiliary personnel, manage intra-dialytic complications, documents and maintains dialysis patient records.

Recognition of Title and qualification

Within the multidisciplinary team, the professional responsible for the direct monitoring of the patient and machine during the course of dialysis is the Dialysis Therapy Technologist also at times referred to as the hemodialysis technologists or patient care technologists (PCTs).

The recommended title thus stands as the Dialysis Therapy Technologist for this group of professionals.

It is a known fact that with the career advancement, the nomenclature will also vary and will also depend on the sector and profile of the professional. Considering the 10 NSQF levels designed by the ILO, the following level progression table has been proposed by the taskforce to map the nomenclature, career pathways and progression in different sectors of professional practice for Dialysis Therapy Technologist. **The proposed progression is for further discussion and**

deliberation, the implementation time of the same may vary depending on the current system and regulations in place.

The table 2 below indicates the various channels of career progression in three distinct sectors such as clinical setting, academic and industry (management/sales or technical) route. It is envisaged that the Dialysis Therapy Technologist will have two entry pathways – students with diploma or bacculaureate. The level of responsibility will increase as the career progresses and will starts with level four (4) for diploma holders and level five (5) for bacculaureate holders. The table also indicates the corresponding level of qualification with experience required by the professional to fulfill the requirements of each level. Considering the degree of patient dealing in case of Dialysis Therapy Technologist and such other professions, government aims to phase out the Diploma and PG Diploma level courses and promote Bachelors’ and Masters’ degree courses. In the academic front, as per UGC guidelines, to work at the position of a Lecturer/Assistant Professor the candidate must attain master degree. At present as there are limited master degree seats in Dialysis Therapy Technology, it has been decided that eventually provisions will be made to provide bridge courses for PG Diploma holders for certain number of years to bring them at par with the master level courses and universities will be promoted to start master degree courses. Although the table indicates that the career progression of a dialysis therapy technologist is upto level 10, it needs to be stated that the ultimate signatory authority on patient prescription stands with the Nephrologist. The director of the dialysis therapy technology unit (clinical route) will be the ultimate authority for the management responsibilities, and the final authority for the clinical decisions will be with the Nephrologist.

Table 2: Nomenclature based on career progression for Dialysis Therapy Technologist (Proposed)

Levels	Nomenclature in various sectors			Qualification and experience
	Clinical	Academic	Industry/ Management	
Level 4	Dialysis Assistant (Diploma)			Diploma with 0-4 years’ experience post Diploma
Level 5	Dialysis Therapy Technologist	Demonstrator	Dialysis Technologist	BSc. DTT with 0-4 years’ experience post BSc. DTT
Level 6	Senior Dialysis Therapy Technologist	Clinical Instructor (Degree) /Lecturer (Post Graduate only)	Senior Dialysis Technologist	*BSc. DTT with 4 years’ experience post BSc. DTT *MSc. DTT with 0-1 years post MSc. DTT
Level 7	Chief Dialysis Therapy Technologist	Senior Clinical Instructor (Degree) or Assistant Professor (Post Graduate only)	Chief Dialysis Technologist	*BSc. DTT with 8 years’ experience post BSc. DTT *MSc. DTT with 4 years post MSc. DTT *PhD with 0-1 years post PhD
Level 8	Deputy Manager for Dialysis Therapy Unit	Associate Professor (Post Graduate only)	Deputy Manager for Dialysis Technology	*BSc. DTT with 12 years’ experience post BSc. *MSc. DTT with 8 years post MSc. DTT *PhD with 4 years post PhD
Level 9	Additional Director for Dialysis Therapy Unit	Professor (Post Graduate only)	Additional Director for Dialysis Technology	*BSc. DTT with 16 years’ experience post BSc. DTT *MSc. DTT with 12 years post MSc. DTT *PhD with 8 years post PhD
Level 10	Director for Dialysis Therapy	Dean / Principal) (Post Graduate only)	Director for Dialysis	*BSc. DTT with 20 years’ experience post BSc. DTT

Career progression ↓

Levels	Nomenclature in various sectors			Qualification and experience
	Clinical	Academic	Industry/ Management	
	Unit (HOD) (Post Graduate or doctoral only)		Technology	*MSc. DTT with 16 years post MSc. DTT *PhD with 12 years post PhD

Definition of Dialysis Therapy Technologist

“Dialysis therapy Technologists” means a person having

Graduate degree in Dialysis therapy technology obtained after the completion of a full time course of 4 years(baccalaureate) which includes supervised clinical training from any university recognized by the university grants commission established under the university grants commission act 1956; or

Post graduate degree in Dialysis therapy technology after completion of a full time course of two years and or/ PhD in the same.

Dialysis Therapy Technologists were also referred previously as “Dialysis Technologist”, or “Patient Care Technologist” means allied and healthcare professionals who operates and maintain an artificial kidney machine, following approved methods to provide dialysis treatment for patients with chronic kidney disease.

Education

When developing any educational programme, it is necessary that it should be planned such that it is outcome-based, and it meets not just the local and national manpower requirements, but also provides personal satisfaction and career potential for professionals with supporting pathways for their development. One of the major changes is the paradigm shift of the focus from traditional theoretical knowledge to one on skills- and competency-based education and training. Optimal education/training requires that the student is able to integrate knowledge, skills and attitude in order to be able to perform a professional act adequately in a given situation.

Thus the following curriculum has been designed accordingly in a prescriptive fashion, with an aim to standardize the content across the nation.

Entry requirements

It is recommended that the students entering this programme should have completed the recognized secondary school studies as the qualification stipulated for the Dialysis Therapy Technology course (diploma/degree), i.e. **10+2 with science or equivalent examination with science subject** from a recognized university or board which would provide the foundation for and prepare them for higher education studies.

Course duration

It is recommended that any programme developed from this curriculum should have a minimum of the following duration to qualify as an entry level course in Dialysis Therapy Technology -

- **2.5 year programme (including 6 months of clinical training/internship)- Diploma level**
- **4 year programme (including 1 year of clinical training /internship)- Bachelor’s degree level**

Initially, the academic content should emphasize on establishing a strong scientific basis and in the latter year, it should focus on the application of theory to clinical/reflective practice. The aim of the degree programme is to enable the development of the Dialysis Therapy Technologist as a key member of the multidisciplinary team and to enable him/her to prepare in advance, plan and execute the dialysis treatment, and assure quality.

With the change in the disease dynamics and multifold increase in the cases needing dialysis treatment, it is imperative that a well-structured programme of postgraduate education is also encouraged so as to enhance research capacity within the country to widen the scope of clinical practice for the profession. Thus, **a master's degree programme is recommended with minimum of two years of education in specialized field of dialysis therapy technology.** The post graduate students can contribute significantly in research and academics.

PhD also play a significant role in the academic system of dialysis therapy technology, however the curriculum has not indicated any prescriptive guidelines for that level apart from mapping it on the career and qualification map.

Teaching faculty and infrastructure

The importance of providing an adequate learning environment for the students cannot be over emphasized. Both the physical infrastructure and the teaching staff must be adequate.

Teaching areas should facilitate different teaching methods. While students may share didactic lectures with other disciplines in large lecture theatres, smaller teaching areas should also be provided for tutorial and problem/case-based learning approaches. In all venues that accommodate students, health and safety standards must be adhered to. It is recommended that a faculty and student ratio of 1:10 be followed.

Job availability

As per the ILO documentation, employers worldwide are not looking for job applicants who can only apply technical skills in the workplace, but for those who can also communicate effectively, including with customers; can work in teams, with good interpersonal skills; can solve problems; have good ICT skills; are willing and able to learn; and are flexible in their approach to work.²⁷

Graduates can expect to be employed in hospitals and private practices as Dialysis Therapy Technologist. A career in research, following the completion of a higher degree such as a PhD, is an option chosen by some graduates. Graduates are eligible for employment overseas where their qualifications, training and experience are highly regarded.

Graduates have good employment prospects, and will enter a field in which the demand for professionals has increased in recent years. Increase in the number of patients with renal failure, stage 5 chronic kidney disease, and end-stage renal ensures a large demand for future graduates.

Chapter 4

Model Curriculum of Dialysis Therapy Technology Courses

Chapter 4: Model Curriculum

Background

Educational programmes should provide the dialysis therapy technologist with a scientific theoretical foundation of the profession and enable them, as practitioners, to be able to synthesize, evaluate and apply their knowledge in a clinical setting.

The aims of the recommended curriculum are to produce dialysis therapy technologist who are:

- Technically and clinically competent;
- Aware of the importance of quality assurance;
- Understand the theoretical basis for evidence-based practice;
- Effective members of the multidisciplinary team;
- Prepared to participate in or initiate research into practice;
- Can work according to registration requirements on the respective continents.

All aspects of dialysis therapy technology have been considered in the development of this curriculum, together with the identification of the roles expected for different levels of dialysis therapy technologist based on their qualification and experience. The need for connecting the dots between the education and employment practices has been the road map for devising this curriculum.

The National Curriculum Taskforce on Dialysis Therapy Technology has successfully designed the career and qualification map indicating growth opportunities for a professional in the career pathway based on the levels indicated in the National Skills Qualification Framework (NSQF). The career pathway indicates **level 4 as the entry level** after the completion of a minimum 2.5 years of a diploma level programme on Dialysis Therapy Technology (Diploma in Dialysis Therapy Technology) and **level 5 as the entry level** after completion of a minimum 4 years of a Baccalaureate level programme on Dialysis Therapy Technology (Bachelor of Science in Dialysis Therapy Technology (BSc.DTT)). The components of the programmes from diploma and above have been detailed in the following chapters.

A foundation course has also been designed to bring all the students at the same level of understanding with respect to basic healthcare-related norms before the start of a career in the field. The foundation course is mandatory for both entry level courses – diploma as well as degree. If a diploma holder has completed the foundation course and is willing to pursue the degree course, the candidate will be able to directly enter the next semester subject to the successful completion of a pre-qualifier skill test. Failure in the test will necessitate a repeat of the foundation course in the first semester.

4.1 Diploma in Dialysis Therapy Technology (DDTT)

Introduction:

Learning objectives:

1. Understand and apply the principles of dialysis; develop skills necessary to provide safe and effective care to the individual undergoing hemodialysis treatments.
2. Demonstrate the use of hemodialysis equipment with an understanding of how to operate dialysis equipment and the knowledge of alternate dialysis procedures.
3. Function as a dialysis professional under the supervision of the physician or nephrologist in a dialysis facility that provides dialysis treatment to the individuals diagnosed with acute or chronic kidney disease.
4. Assess the patient for any complications with an understanding of the problem and recognize the need to report the complications to the physician or nephrologist.
5. Respond effectively to the physical and emotional needs of the patient undergoing dialysis treatment.
6. Able to understand operation, routine maintenance, identification of malfunction, troubleshooting and minor repair for all equipment used in dialysis units such as hemodialysis machines, water treatment plants, dialyzer reprocessing machines, etc.

Expectation from the future graduate in the providing patient care:

1. The primary goal of the Diploma in Dialysis Therapy Technology program is to prepare accomplished professionals in Dialysis Therapy Technology with a specific emphasis on clinical skills and technical knowledge.
2. Trainees acquire the knowledge and procedural skills necessary to deliver a high standard of care to the patients with chronic kidney disease requiring renal replacement therapy.
3. They will also receive training to conduct research in the field of dialysis.
4. This course involves all aspects of care for patients undergoing chronic hemodialysis and continuous ambulatory peritoneal dialysis (CAPD).
5. Overall goal of this training is to foster the trainee's development into an independent care provider in the field of dialysis.
6. The program intends for its graduates to contribute to a new generation of academic dialysis professionals equipped to address the challenging problems in renal replacement therapy.

Eligibility for admission:

Selection procedure

1. Candidate should have passed 10+2 with science.
2. Minimum percentage of marks: 50% aggregate in PCM/B
3. Reservation for SC/ST/OBC categories: As per Govt. of India rules

Provision of Lateral Entry:

Since this is the basic entry level for dialysis professionals, lateral entry is not applicable.

Duration of the course

Duration of the course is of 2.5 years or 5 semesters (inclusive of six months of internship) with 960 hours of Theory & 1200 hours of Practical Classes and another 720 hours dedicated for internship.

Total number of hours – 2880 for the total course

Medium of instruction:

English shall be the medium of instruction for all the subjects of study and for examination of the course.

Attendance:

A candidate will be permitted to appear for the University Examination for any semester if he/she secures not less than 75% of attendance in the number of instructional days at industry during the calendar year, failing which he/she should complete the number of days/hours and undergo the next semester/final examination conducted by the university.

A candidate has to secure minimum 80% in skills training (practical) for qualifying to appear for the final examination. No relaxation, whatsoever, will be permissible to this rule under any ground including indisposition, etc.

Assessment:

Assessments should be completed by the academic staff, based on the compilation of the student's theoretical and clinical performance throughout the training programme. To achieve this, all assessment forms and feedback should be included and evaluated.

Subject	Theory			Practical		Grand Total Marks
	University Exam	Viva-Voce	Internal Assessment	University Exam	Internal Assessment	
Subjects with Practical	80-100	20-30	10-20	40-120	10-30	200-300
Subjects without Practical	70-80	-	20-30	-	-	100

Curriculum Outline

First Semester– Foundation Course

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
DDTT-001	Introduction to Healthcare Delivery System in India	60	0	60
DDTT-002	Basic computers and information Science	10	40	50
DDTT-003	Communication and soft skills	20	10	30
DDTT-004	Medical Terminology and Record keeping (including anatomical terms)	40	0	40
DDTT-005	Medical Law and Ethics	40	0	40
DDTT-006	Introduction to Quality and Patient safety (including Basic emergency care and life support skills, Infection prevention and control, Biomedical waste management, Disaster management and Antibiotic resistance)	40	60	100
DDTT-007	Professionalism and values	20	0	20
DDTT-008	Research Methodology and Biostatistics	40	20	60
DDTT-009	Principals of Management	40	0	40
DDTT-010	Community orientation and clinical visit (including related practical to course 001)*	0	100	100
TOTAL		310	230	540

Teaching resources (tutors) should be made available at every institute for basic subjects such as – Biology and English for students who wish to undertake the extra classes for the same.

Second Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
DDTT-011	Human Anatomy and Physiology	70	30	100
DDTT-012	Biochemistry	30	20	50
DDTT-013	Pharmacology	50	40	90
DDTT-014	Introduction to Kidney diseases- (Part I)	100	100	200
	DDTT Directed Clinical Education – part I (studentship)		100	100
TOTAL		250	290	540

Third Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
DDTT-014	Introduction to Kidney diseases- (Part II)	100	100	200
DDTT-015	Principles and practice of Dialysis (Part I)	100	140	240
	DDTT Directed Clinical Education – part II (studentship)		100	100
TOTAL		200	340	540

Fourth Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
DDTT-015	Principles and practice of Dialysis (Part II)	200	200	400
	DDTT Directed Clinical Education – part III (studentship)		140	140
TOTAL		200	340	540

Fifth Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
	DTT Internship		720	720

Introduction to National Healthcare System

The course provides the students a basic insight into the main features of Indian health care delivery system and how it compares with the other systems of the world. Topics to be covered under the subject are as follows:

1. Introduction to healthcare delivery system
 - a. Healthcare delivery system in India at primary, secondary and tertiary care
 - b. Community participation in healthcare delivery system
 - c. Health system in developed countries.
 - d. Private Sector
 - e. National Health Mission
 - f. National Health Policy
 - g. Issues in Health Care Delivery System in India
2. National Health Programme- Background objectives, action plan, targets, operations, achievements and constraints in various National Health Programme.
3. Introduction to AYUSH system of medicine
 - a. Introduction to Ayurveda.
 - b. Yoga and Naturopathy
 - c. Unani
 - d. Siddha
 - e. Homeopathy
 - f. Need for integration of various system of medicine
4. Health scenario of India- past, present and future
5. Demography & Vital Statistics-
 - a. Demography – its concept
 - b. Vital events of life & its impact on demography
 - c. Significance and recording of vital statistics
 - d. Census & its impact on health policy
6. Epidemiology
 - a. Principles of Epidemiology
 - b. Natural History of disease
 - c. Methods of Epidemiological studies
 - d. Epidemiology of communicable & non-communicable diseases, disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance.

Medical terminologies and record keeping

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.²⁸ Topics to be covered under the subject are as follows:

1. Derivation of medical terms.
2. Define word roots, prefixes, and suffixes.
3. Conventions for combined morphemes and the formation of plurals.
4. Basic 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. Data entry and management on electronic health record system.

Basic computers and information science

The students will be able to appreciate the role of computer technology. The course has focus on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation. Topics to be covered under the subject are as follows:

1. Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
2. Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).
3. Processor and memory: The Central Processing Unit (CPU), main memory.
4. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
5. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
6. Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.
7. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
8. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
9. Introduction of Operating System: introduction, operating system concepts, types of operating system.
10. Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
11. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
12. Application of Computers in clinical settings.

Practical on fundamentals of computers -

1. Learning to use MS office: MS word, MS PowerPoint, MS Excel.
2. To install different software.
3. Data entry efficiency

Medical law and ethics

Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical sciences, growing sophistication of the modern society's

legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.²⁹

Medical ethics has developed into a well based discipline which acts as a "bridge" between theoretical bioethics and the bedside. The goal is "to improve the quality of patient care by identifying, analyzing, and attempting to resolve the ethical problems that arise in practice".²⁹ Doctors are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensus that legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum. Few of the important and relevant topics that need to focus on are as follows:

1. Medical ethics - Definition - Goal - Scope
2. Introduction to Code of conduct
3. Basic principles of medical ethics – Confidentiality
4. Malpractice and negligence - Rational and irrational drug therapy
5. Autonomy and informed consent - Right of patients
6. Care of the terminally ill- Euthanasia
7. Organ transplantation
8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
9. Professional Indemnity insurance policy
10. Development of standardized protocol to avoid near miss or sentinel events
11. Obtaining an informed consent.

Communication and soft skills

Major topics to be covered under Communication course³⁰ –

1. Basic Language Skills: Grammar and Usage.
2. Business Communication Skills. With focus on speaking - Conversations, discussions, dialogues, short presentations, pronunciation.
3. Teaching the different methods of writing like letters, E-mails, report, case study, collecting the patient data etc. Basic compositions, journals, with a focus on paragraph form and organization.
4. Basic concepts & principles of good communication
5. Special characteristics of health communication
6. Types & process of communication
7. Barriers of communication & how to overcome

Introduction to Quality and patient safety

1. Quality assurance and management - The objective of the course is to help students understand the basic concepts of quality in health Care and develop skills to implement sustainable quality assurance program in the health system.
 - a. Concepts of Quality of Care
 - b. Quality Improvement Approaches
 - c. Standards and Norms
 - d. Quality Improvement Tools

- e. Introduction to NABH guidelines
2. Basics of emergency care and life support skills - Basic life support (BLS) is the foundation for saving lives following cardiac arrest. Fundamental aspects of BLS include immediate recognition of sudden cardiac arrest (SCA) and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED). Initial recognition and response to heart attack and stroke are also considered part of BLS. The student is also expected to learn about basic emergency care including first aid and triage. Topics to be covered under the subject are as follows:
 - a. Vital signs and primary assessment
 - b. Basic emergency care – first aid and triage
 - c. Ventilations including use of bag-valve-masks (BVMs)
 - d. Choking, rescue breathing methods
 - e. One- and Two-rescuer CPR
 - f. Using an AED (Automated external defibrillator).
 - g. Managing an emergency including moving a patient

At the end of this topic, focus should be to teach the students to perform the maneuvers in simulation lab and to test their skills with focus on airways management and chest compressions. At the end of the foundation course, each student should be able to perform and execute/operate on the above mentioned modalities.

3. Bio medical waste management and environment safety- The aim of this section will be to help prevent harm to workers, property, the environment and the general public. Topics to be covered under the subject are as follows:
 - a. Definition of Biomedical Waste
 - b. Waste minimization
 - c. BMW – Segregation, collection, transportation, treatment and disposal (including color coding)
 - d. Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste
 - e. BMW Management & methods of disinfection
 - f. Modern technology for handling BMW
 - g. Use of Personal protective equipment (PPE)
 - h. Monitoring & controlling of cross infection (Protective devices)
4. Infection prevention and control - The objective of this section will be to provide a broad understanding of the core subject areas of infection prevention and control and to equip AHPs with the fundamental skills required to reduce the incidence of hospital acquired infections and improve health outcomes. Concepts taught should include –
 - a. Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)],
 - b. Prevention & control of common healthcare associated infections,
 - c. Components of an effective infection control program, and
 - d. Guidelines (NABH and JCI) for Hospital Infection Control
5. Antibiotic Resistance-
 - a. History of Antibiotics

- b. How Resistance Happens and Spreads
 - c. Types of resistance- Intrinsic, Acquired, Passive
 - d. Trends in Drug Resistance
 - e. Actions to Fight Resistance
 - f. Bacterial persistence
 - g. Antibiotic sensitivity
 - h. Consequences of antibiotic resistance
 - i. Antimicrobial Stewardship- Barriers and opportunities, Tools and models in hospitals
6. Disaster preparedness and management- The objective of this section will be to provide knowledge on the principles of on-site disaster management. Concepts to be taught should include-
- a. Fundamentals of emergency management,
 - b. Psychological impact management,
 - c. Resource management,
 - d. Preparedness and risk reduction,
 - e. Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction), information management, incident command and institutional mechanisms.

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 is professionalism in terms of healthcare system 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

Research Methodology and Biostatistics

The objective of this is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings.

- 1. Introduction to research methods
- 2. Identifying research problem
- 3. Ethical issues in research
- 4. Research design
- 5. Basic Concepts of Biostatistics
- 6. Types of Data
- 7. Research tools and Data collection methods
- 8. Sampling methods
- 9. Developing a research proposal

Principals of Management

The course is intended to provide a knowledge about the basic principles of Management.

1. Introduction to management
2. Strategic Management
3. Foundations of Planning
4. Planning Tools and Techniques
5. Decision Making, conflict and stress management
6. Managing Change and Innovation
7. Understanding Groups and Teams
8. Leadership
9. Time Management
10. Cost and efficiency

Community orientation and clinical visit

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 undergraduate 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.³¹

1. The community orientation and clinical visit will include visit to the entire chain of healthcare delivery system -Sub centre, 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 visit to their respective professional department within the hospital.

Second Semester

Human Anatomy & Physiology:

1. Introduction to anatomy
Scope of Anatomy and Physiology, Definitions and Terms, Structure and functions of the human cell, Elementary tissues of the human body, Brief account on Composition of Blood, functions of blood elements, Blood Group and coagulation of blood, Inflammation, Cellular adaptation, Cell injury & cell death.
2. Cardio Vascular System
Structure and functions of various parts of the heart, arterial and venous system, brief account on common cardiovascular disorders
3. Respiratory System
Various parts of respiratory system and their functions, Physiology of Respiration
4. Digestive System
Names and various parts of the digestive system – Liver, Spleen, Gall Bladder, Pancreas, Buccal Cavity, Pharynx, Oesophagus, Stomach, intestine etc.-physiology of digestion and absorption
5. Urinary System

- Various parts of urinary system and its function, structure and function of kidneys, physiology of urine formation, pathophysiology of renal disease and edema
6. Reproductive System
Physiology and anatomy of Male & Female reproductive system-Prostate, Uterus, Ovaries, etc.
 7. Musculoskeletal System
Classification of bones & joints, structure of skeleton –structure of skeletal muscle – physiology of muscle contraction
 8. Nervous System
Various parts of nervous system, brain and its parts, functions of the nervous system; and Spinal Cord & Nerves
 9. Ear, Nose, Throat and Eye
Elementary knowledge of structure and functions of organs of taste, smell, hearing, vision
 10. Endocrine System
Endocrine glands, their hormones and functions – Thyroid, Parathyroid, Suprarenal, Pituitary, pituitary and Thymus
 11. Haemopoietic and Lymphatic System
Name of the blood vessels & lymph gland locations, arterial and venous system of the upper and lower limbs with special reference to vascular access
 12. Surface Anatomy & Surface Markings of Human Body

Practical

1. Study of Human Skeleton parts with skeletal models.
2. Study with charts and models of all organ systems mentioned above.
3. Microscopic slides examination of elementary human tissues, cells.

Biochemistry:

1. Carbohydrates
Glucose and Glycogen Metabolism
2. Proteins:
Classification of proteins and functions
3. Lipids:
Classification of lipids and functions
4. Enzymes
Definition, Nomenclature, Classification, Factors affecting enzyme activity, Active site. Coenzyme, Enzyme Inhibition, Units of enzymes, Isoenzymes and Enzyme pattern in diseases
5. Vitamins & Minerals:
Fat soluble vitamins (A, D, E, K), water soluble vitamins, B-complex vitamins, principal elements (Calcium, Phosphorus, Magnesium, Sodium, Potassium, Chlorine and Sulphur), trace elements, calorific value of foods, Basal Metabolic Rate (BMR), Respiratory Quotient (RQ), Specific Dynamic Action (SDA), balanced diet, Marasmus and Kwashiorkor

6. Acids and bases:
Definition, pH, Henderson – Hassel Balch equation, Buffers, Indicators, Normality, Molarity, Molality

Practical

1. Benedict's test
2. Heat coagulation tests

Pharmacology:

1. IV fluid therapy with special emphasis in renal diseases
Define IV fluids; differentiate between various IV fluids; use of crystalloids and colloids in renal diseases; mode of action, contraindication, precautions and side effects of using various IV fluids.
2. Diuretics
Introduction to diuretics, definition, classification, actions, dosage, side effects & contraindications
3. Anti-hypertensives
Definition, classification, actions, dosage, side effects & contraindications, special reference during dialysis, vasopressors, drugs used in hypotension
4. Drugs & dialysis
Dose & duration of drugs used in dialysis, administration of drugs and the effect of dialysis on the action of drugs
5. Dialyzable drugs
List of drugs that are dialyzable; action, dosage, side effects and contraindications of phenobarbitone, lithium, methanol, etc.
6. Iron
Use of Iron therapy in dialysis; its metabolism, role in RBC formation and anemia; forms of iron therapy; indications for use; available forms and dosages
7. Erythropoietin
History of the development and use of erythropoietin; its action, function; primary role in RBC formation and secondary role; mechanism of action; synthesis and regulation; indications for use; available forms and dosages
8. Heparin including low molecular weight heparin and heparin alternatives
Introduction to heparin and low molecular weight heparin, description of heparin & LMWH, pharmacokinetics, mode of action, indications and use, dosage and route of administration & side effects
9. Protamine sulphate
Introduction to protamine, mode of action, pharmacokinetics, indications, uses, dosage, route of administration, side effects, precautions, contraindications

10. Formalin, citrate, sodium hypochlorite, hydrogen peroxide
Action, characteristics, the use of the drugs, its role as disinfectants, and adverse effects of residual particles applicable to formalin
11. Hemodialysis concentrates
Composition & dilution (acetate & bicarbonates)
12. Peritoneal dialysis fluid in particular hypertonic solutions – composition
Fluids used in peritoneal dialysis, the composition and strength of concentration, mode of action, uses, indications and precaution
13. Potassium exchange resins with special emphasis on mode of administration
Introduction to potassium exchange resins; chemical composition; types, mode of action, indications for use; side effects, precautions and contraindications

Introduction to Kidney Disease – (Part I):

1. Assessment and Diagnostic studies of the Urinary system
Physical assessment of a person with kidney disease, basics of assessment, list various diagnostic tests done for kidney diseases, laboratory tests, imaging studies, normal values, interpretation of the tests including the roles and responsibilities of a technologist.
2. Classification of renal diseases
Define renal disorders, introduction to the classification of various types of renal disorders
3. Glomerular diseases – causes, types & pathology
Definition, etiology, pathophysiology of each type, medical and surgical management
4. Tubulointerstitial diseases & renal vascular disorders
Definition, etiology, pathophysiology of each type, medical and surgical management
5. Acute Kidney Injury
Definition, etiology, pathophysiology of each type, medical and surgical management
6. End stage renal diseases – causes & pathology
Definition, etiology, types of pathophysiology, medical and surgical management

Practicum

1. Care of Patient with CKD
2. Care of Patient with ARF
3. Health teaching on prevention of UTI
4. Health teaching on prevention of peritonitis

DDT Directed Clinical Education – part I (studentship)

Students will observe the basic operations of the dialysis unit while interacting with the multidisciplinary team members involved in providing optimal care to dialysis patients. The student will be introduced to various terminology, equipment, and techniques used for treatment.

Introduction to Kidney Disease – (Part II):

7. Pathology of kidney in hypertension, diabetes mellitus, pregnancy
Definition, etiology, pathophysiology of each type, medical and surgical management
8. Pathology of peritoneum – peritonitis – bacterial, tubercular & sclerosing Peritonitis
Definition, etiology, types of pathophysiology, medical and surgical management
9. Pathology of urinary tract infections
Definition of UTIs, Common organisms involved, etiology, pathophysiology of UTI, medical and surgical management
10. Pyelonephritis & tuberculous pyelonephritis
Definition, etiology, types of pathophysiology, medical and surgical management
11. Dialysis in the intensive care setting
Emergency care & intensive care of a dialysis patient, principles of Extracorporeal Short Wave Lithotripsy, Plasmapheresis, Hemoperfusion, MARS, CRRT & SLED, common urosurgical procedures & instruments and their maintenance, preparation of dialysis patients for various surgical procedures and post-operative dialysis support, basic and advanced cardiac life support.

Practicum

1. Care of Patient with CKD
2. Care of Patient with ARF
3. Health teaching on prevention of UTI
4. Health teaching on prevention of peritonitis

Principles and practice of Dialysis (Part I):

1. History, types of dialysis
Genesis of dialysis, invention and the process involved in the evolution of dialysis, types of dialysis and classification, dialysis for acute kidney injury and chronic kidney disease, introduction to Continuous Renal Replacement Therapy (CRRT)
2. Principles of dialysis, quantification of adequacy
Principles of diffusion, filtration, ultra-filtration, convection, osmosis and diafiltration; solute transport and fluid movement during dialysis; principles of fluid dynamics; hemodialysis and peritoneal dialysis; measuring dialysis adequately: Urea reduction ratio - Urea Kinetic Modeling; pre-dialysis and post-dialysis – BUN measurement, measurement of KT/V.
3. Dialysis Team – rights, responsibilities, patient-doctor relationship
Overview of the dialysis team; responsibilities of a technologist, nurse and doctor in the dialysis setting; building effective working relationships; its importance; dealing with difficult working relationships; respecting the rights of the patient(s); conflict management
4. Dialysis reuse
History of dialyzer reprocessing, reason for dialysis reprocessing, steps involved in dialyzer reprocessing, hazards of dialyzer reprocessing, documentation for dialyzer reprocessing

5. Dialyzer Membranes

Introduction to dialyzer membranes; composition of the dialyzer membranes; types, uses and sizes of the various membranes; principles on which the dialyzer membranes work; newer dialysis membranes and advantages; dialysis membrane: structure, characteristics [molecular weight cut off, ultrafiltration coefficient (Kuf), mass transfer coefficient (KoA) and efficiency, low and high flux, clearance (K)]; Bio-compatibility; High performance membranes

6. Vascular Access – Temporary & Permanent

Types of vascular access – Fistulae, Grafts, Catheters; pre-dialysis assessments for all types of vascular access; methods of needle insertion for AVFs and grafts; pre-dialysis assessment, accessing procedure, exit site care, and monitoring of catheters; understanding the role of a vascular access coordinator

7. Equipment, Accessories, Function

Types of equipment used in the dialysis process; parts of a dialysis machine, tubings and water supply for dialysis; overview of the various equipment, accessories and working of a dialysis machine – technology, functioning, calibration, and sterilization of dialysis machine according to their: type/brand, frequency and duration of use; importance of calibration and sterilization, recording (calibration, sterilization and set up details); planning and organizing scheduled maintenance; various indicators, alarms and sensors of the dialysis machine, corrective steps to be taken when a particular alarm goes off; hemodialysis apparatus: types of dialyzer & membrane, dialysate

- a. Dialysis machines:
- b. Latest Hemodialysis machines:
- c. Conventional and Portable Machines
- d. Wearable artificial Kidney
- e. Bioartificial Kidney
- f. Home dialysis machines and patient training
- g. Mechanism of functioning & management:
- h. Hemodialysis machine
- i. Peritoneal dialysis machine

8. Computer applications in Dialysis

Hospital information system and Electronic Medical Records (EMR) in the dialysis unit, scheduling of procedures, application of computers in the monitoring and maintenance of a dialysis unit

9. Dialysate delivery system

Definition of a delivery system, types of delivery systems.

10. Composition of dialysate

Various dialysate compositions, its uses and indications, method for obtaining various compositions of dialysate

11. High flux / high efficiency dialysis
Definition of high flux / high efficiency dialysis, differences between high flux dialysis and hemodialysis, uses and indications for high flux dialysis, complications of high flux dialysis, precautions and contraindications, care during a high flux dialysis
12. Continuous Renal Replacement Therapy / Slow Low Efficiency Dialysis / Other dialysis related therapies.
Definition, indications, uses, method of initiation of dialysis, contraindications of therapy; complications of therapy and ways to prevent complications; monitoring during SLED and CRRT; technologist's roles and responsibilities during CRRT & SLED
13. Complications in dialysis patients
List various complications seen in patients on dialysis, prevention of complications, education to patient on prevention of complications, emergency management of hypotension & hemorrhage
14. Water treatment-pretreatment, deionizer, Reverse Osmosis
Purpose of water treatment for dialysis; components of a dialysis centre's water treatment system; advantages and disadvantages of water softeners, carbon tanks, reverse osmosis, deionization, and ultraviolet irradiation in the treatment of water for dialysis; monitoring of water treatment systems – disinfection, microbiological testing, water sampling and chemical monitoring; method for microbiological testing of the water treatment system; typical water treatment monitoring schedule; reverse osmosis process and system: definition of RO, cartridge pre – filter, reverse osmosis pump and monitor assembly, RO membranes; quality assessment mechanisms – JCI requirements, ISO requirements, checklists and tools used for optimal compliance
15. Dialysis in Neonates, infants & children
Dialysis for infants and neonates, vascular access in this special group, dialysis settings, monitoring and managing complications
16. Renal data maintenance
Records and reports maintained in the dialysis unit, need for maintenance of records and report, responsibility of the technologist in maintenance of records and report; medico-legal aspects in the maintenance of records.
17. Infection control and sterilization
Morphology of microorganisms, sterilization and disinfection, microbiology of vascular access infection (femoral, jugular, subclavian catheters), sampling methodologies for culture & sensitivity, principles and practice of biomedical waste management
18. Introduction to Kidney Transplantation:
Introduction to the basics of kidney transplantation, comprehending recipient evaluation, understanding pre-transplant care of patients on dialysis, understanding the role of a coordinator in kidney transplantation
19. Prevention of Renal Disease
Staging and causes of chronic kidney disease, early diagnosis of CKD, counseling on adequate control of diabetes and hypertension, methods to control the progression of CKD,

avoiding nephrotoxic drugs, community counseling and awareness about kidney disease, importance of annual master health checkups after 40 years of age, diet and medication counseling for CKD patients, early diagnosis and management of complications of CKD (anemia, malnutrition, mineral bone disease), preparing a patient before ESRD (e.g. early creation of AV fistula etc.)

DDTT Directed Clinical Education – part II (studentship)

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 nephrologist or senior dialysis therapy technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

Fourth Semester

Principles and practice of Dialysis (Part II):

1. Preparation and positioning of patient for dialysis
2. Patient Assessment – Pre, intra & post dialysis & Machine and patient monitoring during Hemodialysis
Introduction to patient assessment, Understanding a treatment plan, Equipment preparation – Dialysate - Dialyzer and Bloodlines - Decisions regarding the appropriate size and type of catheter/ IV tubing to be used –Connecting patients to the machine- Initiation of dialysis - Removing fluid - Replacing fluid - Drawing blood samples - Testing blood samples. Measuring dialysis adequately: Urea reduction ratio - Urea Kinetic Modeling. Pre –dialysis and post dialysis - BUN Measurement. Factors affecting dialysis treatment, communicating and documenting the findings prior to the dialysis process. Starting the dialysis treatment: Monitoring during dialysis - Patient Monitoring (blood pressure, temperature, rate of blood flow, proper mixture of dialysate, and presence of air bubbles) - Technical Monitoring. Importance of reporting, HD Complications during dialysis: Clinical complications - Technical Complications- Procedure to disconnect the patient - procedure for removing the IV cannula-Post dialysis procedures, Post dialysis patient evaluation, Recording of the Treatment, Recording changes in Patient’s condition, Preparation of status and progress reports, Equipment clean up and Maintenance, Recording the dialysis procedure on the medical report/chart of the patient, Discussion of practical clinical case scenarios involving above topics wherever possible.
3. Lab data analysis
Tests done for a patient on Hemodialysis, interpretation of tests and normal values. Discussion of practical clinical case scenarios involving above topics wherever possible.
4. Acute and chronic dialysis prescription
Common drugs for patients with ARF & CRF, Actions, side effects and special considerations. Discussion of practical clinical case scenarios involving above topics wherever possible.
5. Medications in dialysis patients
List the common drugs used for a patient on dialysis. Use of antibiotics during and post dialysis, considerations to be taken. Erythropoietin use in patients on dialysis - dosage and administration. Iron preparations for oral and parental use for renal anemia- dosage,

administration and side effects. Antihypertensive use - considerations during dialysis. Cardiac medications- used in patients on dialysis. Vaccines for patients on hemodialysis - need and the schedule. Discussion of practical clinical case scenarios involving above topics wherever possible.

6. Nutrition management in dialysis patients

Introduction to nutrition and RDA's. Renal diet. Teaching for a patient on renal diet. Foods to avoid, method of cooking to be employed. Planning a renal diet for a patient with chronic kidney disease. Screening for under nutrition among dialysis patients.

Discussion of practical clinical case scenarios involving above topics wherever possible.

7. Anticoagulation

Use of anticoagulation in the dialysis setting, various anticoagulants used in dialysis. Monitoring during use of anticoagulants. Method of administration. Calculation of anticoagulant use & complications. Role and indications for antidote use. Heparin free dialysis - need and indication. Regional citrate anticoagulation. Discussion of practical clinical case scenarios involving above topics wherever possible.

8. Hemodialysis machine specific technology:

Flow system, blood monitoring and control systems, arterial blood flow monitoring, the blood pump, air detection, venous blood flow/pressure monitoring, single needle system, dialysate monitoring and control systems, conductivity, temperature, deaeration and degassing, ultrafiltration & negative pressure, TMP and volumetric control, blood leak detection, isolated ultrafiltration, sodium, bicarbonate and ultrafiltration profiling, blood volume monitoring, blood temperature monitoring. Repair techniques and procedures, fault diagnostics, computer aided maintenance and planned preventative maintenance.

9. Hemodialysis

The process of Hemodialysis, vascular access. Starting Hemodialysis, priming of the dialyzer, alarms and the settings of a dialyzer, completion of Hemodialysis, closing the Hemodialysis. Cleaning of the tubing's and dialyzer and the dialysis machine. Discussion of practical clinical case scenarios involving above topics wherever possible.

10. Complications of Hemodialysis– Acute & chronic

Complications of Hemodialysis, acute complications – monitoring, prevention for acute complications. Chronic complications – list, prevention strategies, monitoring for chronic complications. Discussion of practical clinical case scenarios involving above topics wherever possible.

11. Peritoneal Dialysis

Acute and Chronic Peritoneal Dialysis. History, access, physiology of Peritoneal Dialysis. PD – Transport kinetics, ultrafiltration, UF, Intermittent PD, Continuous Ambulatory Peritoneal Dialysis, Automated Peritoneal Dialysis, Dialysis Solutions, Novel uses of PD. Adequacy of peritoneal dialysis chronic peritoneal Dialysis - KT/V Creatinine clearance. PET - Peritoneal Equilibrium test and interpretation. Discussion of practical clinical case scenarios involving above topics wherever possible.

12. Infectious and noninfectious complications of PD
Introduction to complications in peritoneal dialysis. List of Complications: Catheter Infections Peritonitis Inadequate flow or drainage of the dialysis fluid Lesions Ultra filtration failure. Management of exit site infection, Early Exit Site Care. Chronic Care of the Healed Exit Site Diagnosing Exit Site Infections Treatment of exit-site infections Technique to culture exit site infection Medical management of CAPD peritonitis Initiation of therapy based on gram stain results Antibiotic selection, Discussion of practical clinical case scenarios involving above topics wherever possible.
13. Infection control and universal precautions
Introduction to infection control practices, need for infection control, and burden of hospital acquired infection. Introduction to universal precautions - Hand washing – Personal protective equipment – contact precaution, air borne precaution, droplet precaution - - Protection from contamination - Cleaning and disinfecting – common pathogens and their route of transmission- HIV AIDS and its spread. Biomedical waste management- Employee Health Policy- Record and report infection control procedures. Discussion of practical clinical case scenarios involving above topics wherever possible.
14. Psychosocial aspects & patient education
Psychological impact of a chronic disease. The financial implications of the disease. The family and its role in the care of the patient with CRF. Patient education - Diet, prevention of complications, drug compliance. Discussion of practical clinical case scenarios involving above topics wherever possible.
15. Instruct patients about in-home treatment and precaution
Identification of the type of patient for whom in house treatment is possible and in line with doctor's advice, procedure of in-house treatment options, pros and cons of in-house treatment options, The relevant protocol and procedures to be followed to carry out the process. Discussion of practical clinical case scenarios involving above topics wherever possible.
16. Quality assurance in dialysis
Standards of practice, various risks to quality and safety, JCI recommendations, NABH recommendations. Infection control policies and procedures in the dialysis unit. Discussion of practical clinical case scenarios involving above topics wherever possible.
17. General principle of hospital practice
Hospital structure and organization, Care of Patient, Basic Assessment Skills, First aid & Basic Life Support (BLS) and certification, Maintenance of Hygiene & Infection Control Practices, Principles of asepsis, Maintenance of Medications in the department, Specialized Investigations - Care of Patients, Medico - Legal Issues
18. General principle of Epidemiology and Statistics
Dynamics of disease transmission, measuring disease – morbidity and mortality, overview of clinical examination, diagnostic tests and interpretation of diagnostic data. Basic mathematical and measurement concepts, concepts of frequency distributions, central tendency and variability, normal distribution curve and standard curves, correlation and regression. Sampling techniques and introduction to research methodology.

19. Recent advances in Nephrology

ISO RO water standard for hemodialysis, Wearable Artificial Kidney, Novel markers of AKI, Current Research in Dialysis, ABO incompatible transplantation, Online Hemodiafiltration, Online Hemofiltration, Online Hemodialysis, Extracorporeal Therapies in Special Situations

DDTT Directed Clinical Education – part III (studentship)

Students will improve their skills in clinical procedures. Progressive interaction with patients and professional personnel are monitored as students practice in dialysis therapy technology unit in a supervised setting. Additional areas include problem solving, identifying machine components and basic side effect management. Students will demonstrate competence in beginning and intermediate procedures.

Fifth Semester

Internship:

The internship will span 6 months/ 1 semester. This will include 8 hours of practice a day, totaling to 720 hours for one semester.

As a part of this, the students will choose a relevant subject and prepare an in-depth project report of not less than 1000 words which will be handed over to the supervisor or trainer. The report can include objective, scope of the project and an in-depth report.

The internship time period provides the students the opportunity to continue to develop confidence and increased skill in simulation and treatment delivery. Students will demonstrate competence in beginning and intermediate procedures. Students will observe the advanced and specialized treatment procedures. The student will complete the clinical training by practicing all the skills learned in classroom and clinical instruction. The students are expected to work for minimum 8 hours per day and this may be more depending on the need and the healthcare setting.

Skills based outcomes and monitorable indicators for Dialysis Assistant

Competency statements

1. Demonstrates ability to provide safe and effective care to the individual
2. Understands the process of operating dialysis equipment and how to perform alternate dialysis procedures.
3. Assesses the patient for any complications with an understanding of the problem and recognizes the need to report the complications to the physician or nephrologist
4. Responds effectively to the physical and emotional needs of the patient undergoing dialysis treatment
5. Demonstrates a sensitive and caring attitude towards the patient
6. Demonstrates knowledge and ability to operate and maintain all equipment in the dialysis unit.
7. Communicates relevant information to other members and completes accurate documentation
8. Demonstrates ability to correctly position the patient
9. Demonstrates professional behavior

S. no.	Learning outcomes	Knowledge/comprehension	Applications / synthesis /evaluation	Hours
1	Provides safe and effective care to the individual	Factual knowledge of the principles of dialysis; hemodialysis preparations, methods and techniques; and quality control measures	Demonstrates appropriate use of barrier precautions and cleaning and disinfection procedures	200
2	Understands the process of operating dialysis equipment and how to perform alternate dialysis procedures	Determines tests and procedures appropriate to the patient's condition and abilities, with nephrologist	Formulates an examination plan based on the patient history	400
3	Assesses the patient for any complications with an understanding of the problem and recognizes the need to report the complications to the physician or nephrologist	Knowledge of possible complications and ways to treat them, ability to recognize dialyzer reaction and involve appropriate supervisory support if needed	Responds properly to patient complaints and takes appropriate measures including emergency termination of dialysis if needed	300
4	Responds effectively to the physical and emotional needs of the patient undergoing dialysis treatment	Ensures a structured, efficient, rational and comfortable exchange of information	Communicates with the patient taking into account his/her physical, emotional, intellectual and cultural background	100
5	Operation and Maintenance of all equipment	Factual knowledge of the appropriate system start up procedure and alarm systems function test	Performs basic operator troubleshooting, appropriately initiates, monitors and terminates chemical disinfect procedure for machine, dialyser and tubing	200
	Total			1200

4.2 Bachelor of Science in Dialysis Therapy Technology (BSc.DTT)

Introduction:

Learning Objectives: At the completion of this course, the student should be –

1. Understand and apply the principles of dialysis and skills necessary to give safe and effective care to the individual undergoing hemodialysis treatments
2. Demonstrate the use of hemodialysis equipment with an understanding of the process of operating dialysis equipment and alternate dialysis procedures
3. Function as a dialysis professional under the supervision of the physician or nephrologist in a dialysis facility that provides dialysis treatment to the individuals diagnosed with acute or chronic kidney disease.
4. Assess the patient for any complications with an understanding of the problem and recognize the need to report the complications to the physician or nephrologist
5. Respond effectively to the physical and emotional needs of the patient undergoing dialysis treatment.
6. Develop the ability to understand operation, routine maintenance, identification of malfunction in equipment, troubleshooting and minor repair in equipment used in dialysis unit such hemodialysis machine, water treatment plant, dialyzer reprocessing machine, etc.

Expectation from the future graduate in the providing patient care

1. The primary goal of the Degree in Dialysis Therapy Technology program is to prepare accomplished professionals in Dialysis Therapy Technology with a specific emphasis on clinical skills and technical knowledge.
2. Trainees acquire the knowledge and procedural skills necessary to deliver a high standard of care to the patients with chronic kidney disease requiring renal replacement therapy.
3. They will also receive training to conduct research in the field of dialysis.
4. This course involves all aspects of care for patients undergoing chronic hemodialysis and continuous ambulatory peritoneal dialysis (CAPD).
5. Overall goal of this training is to foster the trainee's development into an independent care provider in the field of dialysis.
6. The program intends for its graduates to contribute to a new generation of academic dialysis professional equipped to address the challenging problems in renal replacement therapy.

Eligibility for admission:

Selection procedure:

1. Candidate should have passed 10+2 with science or have done Diploma in Dialysis Therapy Technology
2. Minimum percentage of marks: 50% aggregate in PCM/B
3. Reservation for SC/ST/OBC categories: As per Govt. of India rules.

Provision of Lateral Entry:

There should be a provision for lateral entry for the students who have successfully completed Diploma in Dialysis Therapy Technology and would like to pursue B.Sc. Dialysis Therapy Technology /BSc.DTT. In such a case, they can directly enter into the second year or 3rd semester.

Duration of the course

Duration of the course: 4 years or 8 semesters. (900 hours of Theory & 2340 hours of Practical Classes) and 1440 hours (minimum) of internship

Total hours - 4680

Medium of instruction:

English shall be the medium of instruction for all the subjects of study and for examination of the course.

Attendance:

A candidate has to secure minimum 80% attendance in overall with at least-

1. 75% attendance in theoretical
2. 80% in Skills training (practical) for qualifying to appear for the final examination.

No relaxation, whatsoever, will be permissible to this rule under any ground including indisposition, etc.

Assessment:

Assessments should be completed by the academic staff, based on the compilation of the student's theoretical and clinical performance throughout the training programme. To achieve this, all assessment forms and feedback should be included and evaluated.

Curriculum Outline

First Semester– Foundation Course

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
BSc.DTT-001	Introduction to Healthcare Delivery System in India	60	0	60
BSc.DTT-002	Basic computers and information Science	10	40	50
BSc.DTT -003	Communication and soft skills	20	10	30
BSc.DTT -004	Medical Terminology and Record keeping (including anatomical terms)	40	0	40
BSc.DTT -005	Medical Law and Ethics	40	0	40
BSc.DTT -006	Introduction to Quality and Patient safety (including Basic emergency care and life support skills, Infection prevention and control, Biomedical waste management, Disaster management and Antibiotic resistance)	40	60	100
BSc.DTT -007	Professionalism and values	20	0	20
BSc.DTT -008	Research Methodology and Biostatistics	40	20	60
BSc.DTT -009	Principals of Management	40	0	40
BSc.DTT -010	Community orientation and clinical visit (including related practical to course 001)*	0	100	100
TOTAL		310	230	540

Teaching resources (tutors) should be made available at every institute for basic subjects such as – Biology and English for students who wish to undertake the extra classes for the same.

Second Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
BSc.DTT -011	Human anatomy	40	80	120
BSc.DTT -012	Physiology	40	80	120
BSc.DTT -013	Applied anatomy & physiology related to Dialysis Therapy Technology	40	80	120
BSc.DTT -014	Biochemistry	30	50	80
	BSc.DTT Directed Clinical Education – part I (studentship)	-	100	100
TOTAL		150	390	540

Third Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
BSc.DTT -015	Pathology	50	80	130
BSc.DTT -016	Microbiology	50	80	130
BSc.DTT -017	Applied pathology & microbiology related to Dialysis Therapy Technology	50	80	130
	BSc.DTT Directed Clinical Education – part II (studentship)		150	150
TOTAL		150	390	540

Fourth Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
BSc.DTT -018	General Pharmacology	30	30	60
BSc.DTT -019	Pharmacology related to dialysis technology	50	-	50
BSc.DTT -020	Concepts of renal disease, dialysis & nutrition	60	-	60
BSc.DTT -021	Applied Dialysis Therapy Technology – Part I	50	80	130
	Constitution of India (subsidiary subject)	10	-	-
	BSc.DTT Directed Clinical Education – part III (studentship)	-	240	240
TOTAL		190	350	540

Fifth Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
BSc.DTT -022	Applied Dialysis Therapy Technology – Part II	50	100	150
	BSc.DTT Directed Clinical Education – Part IV (studentship)	-	390	390
TOTAL		50	490	540

Sixth Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
BSc.DTT -023	Applied Dialysis Therapy Technology – Part III	50	100	150
	BSc.DTT Directed Clinical Education – Part V (studentship)	-	390	390
TOTAL		50	490	540

Seventh and Eighth Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
	BSc.DTT Internship		1440	1440

INTERNSHIP – minimum 1440 hours (calculated based on 8 hours per day, if 180 working days in a year)

First Semester- Foundation course

Introduction to National Healthcare System

The course provides the students a basic insight into the main features of Indian health care delivery system and how it compares with the other systems of the world. Topics to be covered under the subject are as follows:

1. Introduction to healthcare delivery system
 - a. Healthcare delivery system in India at primary, secondary and tertiary care
 - b. Community participation in healthcare delivery system
 - c. Health system in developed countries.
 - d. Private Sector
 - e. National Health Mission
 - f. National Health Policy
 - g. Issues in Health Care Delivery System in India
2. National Health Programme- Background objectives, action plan, targets, operations, achievements and constraints in various National Health Programme.
3. Introduction to AYUSH system of medicine
 - a. Introduction to Ayurveda.
 - b. Yoga and Naturopathy
 - c. Unani
 - d. Siddha
 - e. Homeopathy
 - f. Need for integration of various system of medicine
4. Health scenario of India- past, present and future
5. Demography & Vital Statistics-
 - a. Demography – its concept
 - b. Vital events of life & its impact on demography
 - c. Significance and recording of vital statistics
 - d. Census & its impact on health policy
6. Epidemiology
 - a. Principles of Epidemiology
 - b. Natural History of disease
 - c. Methods of Epidemiological studies
 - d. Epidemiology of communicable & non-communicable diseases, disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance.

Medical terminologies and record keeping

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.²⁸ Topics to be covered under the subject are as follows:

1. Derivation of medical terms.
2. Define word roots, prefixes, and suffixes.
3. Conventions for combined morphemes and the formation of plurals.
4. Basic 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. Data entry and management on electronic health record system.

Basic computers and information science

The students will be able to appreciate the role of computer technology. The course has focus on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation. Topics to be covered under the subject are as follows:

1. Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
2. Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).
3. Processor and memory: The Central Processing Unit (CPU), main memory.
4. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
5. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
6. Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.
7. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
8. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
9. Introduction of Operating System: introduction, operating system concepts, types of operating system.
10. Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
11. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
12. Application of Computers in clinical settings.

Practical on fundamentals of computers -

1. Learning to use MS office: MS word, MS PowerPoint, MS Excel.
2. To install different software.
3. Data entry efficiency

Medical law and ethics

Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical sciences, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.²⁹

Medical ethics has developed into a well based discipline which acts as a "bridge" between theoretical bioethics and the bedside. The goal is "to improve the quality of patient care by identifying, analyzing, and attempting to resolve the ethical problems that arise in practice".²⁹ Doctors are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensus that legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum. Few of the important and relevant topics that need to focus on are as follows:

1. Medical ethics - Definition - Goal - Scope
2. Introduction to Code of conduct
3. Basic principles of medical ethics – Confidentiality
4. Malpractice and negligence - Rational and irrational drug therapy
5. Autonomy and informed consent - Right of patients
6. Care of the terminally ill- Euthanasia
7. Organ transplantation
8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
9. Professional Indemnity insurance policy
10. Development of standardized protocol to avoid near miss or sentinel events
11. Obtaining an informed consent.

Communication and soft skills

Major topics to be covered under Communication course³⁰ –

1. Basic Language Skills: Grammar and Usage.
2. Business Communication Skills. With focus on speaking - Conversations, discussions, dialogues, short presentations, pronunciation.
3. Teaching the different methods of writing like letters, E-mails, report, case study, collecting the patient data etc. Basic compositions, journals, with a focus on paragraph form and organization.
4. Basic concepts & principles of good communication
5. Special characteristics of health communication
6. Types & process of communication
7. Barriers of communication & how to overcome

Introduction to Quality and patient safety

1. Quality assurance and management - The objective of the course is to help students understand the basic concepts of quality in health Care and develop skills to implement sustainable quality assurance program in the health system.
 - a. Concepts of Quality of Care
 - b. Quality Improvement Approaches
 - c. Standards and Norms
 - d. Quality Improvement Tools
 - e. Introduction to NABH guidelines

2. Basics of emergency care and life support skills - Basic life support (BLS) is the foundation for saving lives following cardiac arrest. Fundamental aspects of BLS include immediate recognition of sudden cardiac arrest (SCA) and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED). Initial recognition and response to heart attack and stroke are also considered part of BLS. The student is also expected to learn about basic emergency care including first aid and triage. Topics to be covered under the subject are as follows:
 - a. Vital signs and primary assessment
 - b. Basic emergency care – first aid and triage
 - c. Ventilations including use of bag-valve-masks (BVMs)
 - d. Choking, rescue breathing methods
 - e. One- and Two-rescuer CPR
 - f. Using an AED (Automated external defibrillator).
 - g. Managing an emergency including moving a patient

At the end of this topic, focus should be to teach the students to perform the maneuvers in simulation lab and to test their skills with focus on airways management and chest compressions. At the end of the foundation course, each student should be able to perform and execute/operate on the above mentioned modalities.

3. Bio medical waste management and environment safety- The aim of this section will be to help prevent harm to workers, property, the environment and the general public. Topics to be covered under the subject are as follows:
 - a. Definition of Biomedical Waste
 - b. Waste minimization
 - c. BMW – Segregation, collection, transportation, treatment and disposal (including color coding)
 - d. Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste
 - e. BMW Management & methods of disinfection
 - f. Modern technology for handling BMW
 - g. Use of Personal protective equipment (PPE)
 - h. Monitoring & controlling of cross infection (Protective devices)

4. Infection prevention and control - The objective of this section will be to provide a broad understanding of the core subject areas of infection prevention and control and to equip AHPs with the fundamental skills required to reduce the incidence of hospital acquired infections and improve health outcomes. Concepts taught should include –

- a. Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)],
 - b. Prevention & control of common healthcare associated infections,
 - c. Components of an effective infection control program, and
 - d. Guidelines (NABH and JCI) for Hospital Infection Control
5. Antibiotic Resistance-
- a. History of Antibiotics
 - b. How Resistance Happens and Spreads
 - c. Types of resistance- Intrinsic, Acquired, Passive
 - d. Trends in Drug Resistance
 - e. Actions to Fight Resistance
 - f. Bacterial persistence
 - g. Antibiotic sensitivity
 - h. Consequences of antibiotic resistance
 - i. Antimicrobial Stewardship- Barriers and opportunities, Tools and models in hospitals
6. Disaster preparedness and management- The objective of this section will be to provide knowledge on the principles of on-site disaster management. Concepts to be taught should include-
- a. Fundamentals of emergency management,
 - b. Psychological impact management,
 - c. Resource management,
 - d. Preparedness and risk reduction,
 - e. Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction), information management, incident command and institutional mechanisms.

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 is professionalism in terms of healthcare system 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

Research Methodology and Biostatistics

The objective of this is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings.

1. Introduction to research methods

2. Identifying research problem
3. Ethical issues in research
4. Research design
5. Basic Concepts of Biostatistics
6. Types of Data
7. Research tools and Data collection methods
8. Sampling methods
9. Developing a research proposal

Principals of Management

The course is intended to provide knowledge about the basic principles of Management.

1. Introduction to management
2. Strategic Management
3. Foundations of Planning
4. Planning Tools and Techniques
5. Decision Making, conflict and stress management
6. Managing Change and Innovation
7. Understanding Groups and Teams
8. Leadership
9. Time Management
10. Cost and efficiency

Community orientation and clinical visit

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 undergraduate 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.³¹

1. The community orientation and clinical visit will include visit to the entire chain of healthcare delivery system -Sub centre, 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 visit to their respective professional department within the hospital.

Second Semester

Human Anatomy

1. Introduction: Human body as a whole
 - a. Theory:
 - Definition of anatomy and its divisions.
 - Terms of location, positions and planes.
 - Cell and its organelles.
 - Epithelium: definition, classification, describe with examples, function.
 - Glands: classification, describe serous, mucous & mixed glands with examples.
 - Basic tissues: classification with examples

- b. Practical:
 - Histology of types of epithelium.
 - Histology of serous, mucous & mixed salivary gland.
2. Locomotion and support
- a. Theory:
 - Cartilage: types with example & histology.
 - 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.
 - Joints: classification of joints with examples, synovial joint (in detail for radiology).
 - Muscular system: classification of muscular tissue & histology, names of muscles of the body.
 - b. Practical:
 - Histology of the 3 types of cartilage.
 - Demo of all bones showing parts, radiographs of normal bones & joints.
 - Histology of compact bone (TS & LS).
 - Demonstration of all muscles of the body.
 - Histology of skeletal, smooth & cardiac muscle (TS & LS).
3. Cardiovascular system
- a. Theory:
 - Heart: size, location, chambers, exterior & interior, blood supply of heart.
 - 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.
 - b. Practical:
 - Demonstration of heart and vessels in the body.
 - Histology of large artery, medium sized artery & vein, large vein.
 - Histology of lymph node, spleen, tonsil & thymus.
 - Normal chest radiograph showing heart shadows.
 - Relationship to vascular access in dialysis
4. Gastro-intestinal system
- a. Theory:
 - Parts of GIT, oral cavity, lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring, oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, radiographs of abdomen.
 - b. Practical:
 - Demonstration of parts of gastro intestinal system.
 - Normal radiographs of gastro intestinal system.
 - Histology of gastro intestinal system.

5. Respiratory system
 - a. Theory:
 - Parts of RS, nose, nasal cavity, larynx, trachea, lungs, broncho-pulmonary segments, histology of trachea, lung and pleura, names of paranasal air sinuses.
 - b. Practical:
 - Demonstration of parts of respiratory system.
 - Normal radiographs of chest.
 - Histology of lung and trachea.
6. Peritoneum
 - a. Theory:
 - Description in brief.
 - b. Practical:
 - Demonstration of reflections.
7. Urinary system
 - a. Theory:
 - Kidney, ureter, urinary bladder, male and female urethra. Histology of kidney, ureter and urinary bladder.
 - b. Practical:
 - Demonstration of parts of urinary system.
 - Histology of kidney, ureter, urinary bladder.
 - Radiographs of abdomen-IVP, retrograde cystogram.
8. Reproductive system
 - a. Theory:
 - 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.
 - b. Practical:
 - Demonstration of section of male and female pelvis with organs in situ.
 - Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube, ovary.
9. Endocrine glands
 - a. Theory:
 - Endocrine glands: pituitary gland, thyroid gland, parathyroid gland, suprarenal gland (gross & histology).
 - b. Practical:
 - Demonstration of the glands.
 - Histology of pituitary, thyroid, parathyroid, suprarenal glands.
10. Nervous system
 - a. Theory:
 - 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.
 - Sympathetic trunk & names of parasympathetic ganglia.

- b. Practical:
 - Histology of peripheral nerve & optic nerve.
 - Demonstration of all plexuses and nerves in the body.
 - Demonstration of all parts of brain.
 - Histology of cerebrum, cerebellum, spinal cord.
11. Sensory organs:
- a. Theory:
 - Skin: histology, appendages of skin.
 - Eye: parts of eye & lacrimal apparatus. Extra-ocular muscles & nerve supply.
 - Parts of ear: external, middle and inner ear and contents.
 - b. Practical:
 - Histology of thin and thick skin.
 - Demonstration and histology of eyeball.
 - Histology of cornea & retina.
12. Embryology:
- a. Theory:
 - Spermatogenesis & oogenesis.
 - Ovulation, fertilization.
 - Fetal circulation.
 - Placenta.
 - b. Practical:
 - Demonstration of models.

Physiology

Emphasis on plain and cross-sectional radiographic anatomy

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 haemoglobin.
 - 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. Haemostasis: definition, normal haemostasis, 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. Anaemias: 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 gastro intestinal 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 centre, Hering–Breuer reflex.
- f. Applied physiology and respiration: hypoxia, cyanosis, asphyxia, dyspnea, dysbarism, artificial respiration, and apnoea.

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
 - Extrapyramidal tracts, functions of medulla, pons, hypothalamic disorders.
 - Cerebral cortex lobes and functions, sensory cortex, motor cortex, cerebellum, functions of cerebellum. Basal ganglion: functions. EEG.
 - Cerebro Spinal Fluid (CSF): formation, circulation, properties, composition and functions.

- Lumbar puncture.
 - i. Autonomic Nervous System:
 - 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 load, 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.

Practical

1. Haemoglobinometry.
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.

Applied anatomy & Physiology related to Dialysis Therapy Technology:

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.

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. Haemostasis: 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.

Biochemistry

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/litre 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, 0.1N Oxalic acid, 0.1 N HCl, 0.1N H₂SO₄, 0.66 N H₂SO₄ 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: (Theory and Practical)
- Theory
- a. Definition, concept, mechanism of dissociation of an indicator, colour 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.
- Practical
- a. 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.
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.

Practical

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 and electrolytes.
15. Demonstration of strips, demonstration of glucometer.

BSc.DTT Directed Clinical Education – part I (studentship)

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 nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

Third Semester

Pathology

1. Histopathology
 - a. Introduction to histopathology.
 - b. Receiving of specimen in the laboratory.
 - c. Grossing techniques.
 - d. Mounting techniques: various mountants.
 - e. Maintenance of records and filing of the slides.
 - f. Use & care of microscope.
 - g. Various fixatives, mode of action, preparation and indication.
 - h. Section cutting.
 - i. Tissue processing for routine paraffin sections.
 - j. Decalcification of tissues.
 - k. Staining of tissues: H & E Staining.
 - l. Bio-medical waste management.
2. Clinical Pathology
 - a. Introduction to clinical pathology.
 - b. Collection, transport, preservation, and processing of various clinical specimens.
 - c. Urine Examination: collection and preservation of urine, physical, chemical, microscopic examination.
 - d. Examination of body fluids.
 - e. Examination of cerebro spinal fluid (CSF).
 - f. Sputum examination.
 - g. Examination of faeces.
3. Haematology

- a. Introduction to haematology.
 - b. Normal constituents of blood, their structure and function.
 - c. Collection of blood samples.
 - d. Anticoagulants used in haematology.
 - e. Instruments and glassware used in haematology, preparation and use of glassware.
 - f. Laboratory safety guidelines.
 - g. SI units and conventional units in hospital laboratory.
 - h. Hb, PCV.
 - i. ESR.
 - j. Normal haemostasis.
 - k. Bleeding time, clotting time, prothrombin time, activated partial thromboplastin time.
4. Blood Bank
- a. Introduction.
 - b. Blood grouping and Rh types.
 - c. Cross matching.

Practical

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.

Microbiology

1. Morphology
 - a. Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria.
2. Growth and nutrition
 - a. Nutrition, growth and multiplications of bacteria, use of culture media in diagnostic bacteriology.
3. Culture media
 - a. Use of culture media in diagnostic bacteriology, antimicrobial sensitivity test.
4. 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),
 - b. 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
9. Virology
 - a. General properties of viruses, diseases caused lab diagnosis and prevention of following viruses, Herpes, Hepatitis, HIV, Rabies and Poliomyelitis.
10. Hospital infection
 - a. Causative agents, transmission methods, investigation, prevention and control of hospital infection.
11. Principles and practice Biomedical waste management

Practical

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. Grams staining.
8. Acid fast staining.
9. Stool exam for helminthic ova & cysts.
10. Visit to hospital for demonstration of work done by infection control team and biomedical waste management department.

Applied Pathology & Microbiology related to Dialysis Therapy Technology

Pathology

1. Congenital abnormalities of urinary system.
2. Classification of renal diseases.
3. Glomerular diseases: causes, types & pathology.
4. Tubulo-interstitial diseases.
5. Renal vascular disorders.
6. End stage renal diseases: causes & pathology.
7. Pathology of kidney in hypertension, diabetes mellitus, pregnancy.
8. Pathology of peritoneum, peritonitis, bacterial, tubular & sclerosing peritonitis, dialysis induced changes.
9. Pathology of urinary tract infections
10. Pyelonephritis & tuberculous pyelonephritis

Microbiology

1. Hepatotrophic viruses in detail: mode of transfusion, universal precautions vaccinations.
2. Human immunodeficiency virus (HIV), mode of transfusion, universal precautions.
3. Opportunistic infections.
4. Microbiology of urinary tract infections.
5. Microbiology of vascular access infection (femoral, jugular, subclavian catheters).
6. Sampling methodologies for culture & sensitivity.

BSc.DTT Directed Clinical Education – part II (studentship)

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 nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

Fourth Semester

General Pharmacology

1. Concepts of the interactions of chemical agents with living tissues, effect of drugs on the body, drugs and alteration of disease processes, toxicity effects. New drugs testing and development prior to use for patient care.
2. Drug use in renal disease, drugs in special populations (the neonate and infant, the pregnant and elderly), pharmacokinetics, drug interactions, Definitions, routes of drug administration, Pharmacodynamics, adverse drug reactions, therapeutic drug monitoring, pharmacogenomics and principles of individualization of drug therapy.

Pharmacology related to Dialysis Therapy Technology

1. IV fluid therapy with special emphasis in renal diseases.
2. Diuretics: classification, actions, dosage, side effects & contraindications.
3. Anti-hypertensives: classification, actions, dosage, side effects & contraindications, special reference during dialysis, vasopressors, drugs used in hypotension.
4. Drugs & dialysis: dose & duration of administration of drugs.
5. Dialyzable drugs: phenobarbitone, lithium, methanol etc.
6. Vitamin D & its analogues, phosphate binders, iron, folic acid & other vitamins of therapeutic value.
7. Erythropoietin in detail.
8. Heparin, low molecular weight heparin and heparin-induced thrombocytopenia
9. Protamine sulphate as antidote and indication.
10. Alternative anticoagulants.
11. Formalin, citrate, sodium hypochlorite, hydrogen peroxide: role as disinfectants & adverse effects of residual particles applicable to formalin.
12. Hemodialysis concentrates: composition & dilution (acetate & bicarbonates).
13. Peritoneal dialysis fluid in particular hypertonic solutions: composition.
14. Potassium exchange resins with special emphasis on mode of administration.

Concepts of renal disease, dialysis & Nutrition

Basic Concepts of Renal Diseases

1. Acute renal failure.
2. Nephrotic syndrome – primary & secondary.
3. Nephritic syndrome.
4. UTI (urinary tract infections.)
5. Asymptomatic urinary abnormalities.
6. Chronic renal failure.
7. Renal stone diseases.
8. Obstructive uropathies.
9. Congenital & inherited renal diseases.
10. Tumors of kidney.
11. Pregnancy associated renal diseases.
12. Renal vascular disorders & hypertension associated renal diseases.

Basic Concepts of Dialysis Therapy Technology

1. Definition.
2. Indications of dialysis.

3. Types of dialysis.
4. Principles of dialysis.
5. Haemodialysis apparatus - types of dialyzer & membranes.
6. Types of vascular access for haemodialysis.
7. Introduction to haemodialysis machine.
8. Priming of dialysis apparatus.
9. Dialyzer reuse.
10. Common complications of haemodialysis.
11. Monitoring of patients during dialysis.

Basic Concepts of Nutrition

1. Introduction to science of nutrition.
 - a. Definition.
 - b. Food pattern and its relation to health.
 - c. Factors influencing food habits.
 - d. Superstitions, culture, religion, income, composition of family, age, occupation, special group etc.
 - e. Food selection, storage and preservation.
 - f. Prevention of food adulteration.
2. Classification of nutrients.
 - a. Macronutrients and micronutrients.
 - b. Types, sources, requirements and deficiency of proteins.
 - c. Sources, requirements and deficiency of carbohydrates.
 - d. Types, sources, requirements and deficiency of fats.
 - e. Sources, requirement and storage of drinking water.
 - f. Types, sources, requirements and deficiency of minerals.
 - g. Types, sources, requirements and deficiency of vitamins.
3. Planning of diets.
 - a. Need for planning of diets.
 - b. Concepts of balanced diet.
 - c. Food groups and balanced diet.
 - d. Influence of age, sex, occupation & physiological state.
 - e. Recommended dietary intake.
 - f. Steps in planning balanced diet.
 - g. Concepts of balanced diet for dialysis patients.
 - h. Recommended dietary intake for dialysis patients.
 - i. Planning diet for dialysis patients.
 - j. Steps in planning balanced diet for dialysis patients.

Applied Dialysis Therapy Technology – Part I

1. Indications of dialysis.
2. History & types of dialysis.
3. Theory of hemodialysis: diffusion, osmosis, ultra-filtration & solvent drag.
4. Hemodialysis apparatus: types of dialyzer & membrane, dialysate.
 - a. Dialysis Membrane:
 - Structure,
 - Characteristics [molecular weight cut off; Ultrafiltration coefficient(Kuf); Mass transfer coefficient (KoA) and efficiency; Low and high flux; Clearance(K)]
 - Biocompatibility

- Newer membranes.
 - High performance membranes.
5. Physiology of peritoneal dialysis.
 6. Dialysis machines:
 - a. Latest Hemodialysis machine:
 - Conventional and Portable Machines
 - Wearable artificial Kidney
 - The Bioartificial Kidney
 - Home dialysis machines and patient training
 - b. Mechanism of functioning & management:
 - Hemodialysis machine.
 - Peritoneal dialysis machine.
 7. Biochemical investigations required for renal dialysis.
 8. Adequacy of dialysis:
 - a. Hemodialysis.
 - b. Peritoneal dialysis.
 - c. Peritoneal equilibration test (PET).
 9. Anti-coagulation.
 10. Withdrawal of dialysis criteria:
 - a. Acute dialysis.
 - b. Chronic dialysis.
 11. Dialyzer reuse.
 12. Water treatment system.

Constitution of India (subsidiary subject)

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

BSc.DT Directed Clinical Education – part III (studentship)

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 nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

Applied Dialysis Therapy Technology – Part II

1. Dialysis in special situations:
 - a. Patients with congestive cardiac failure.
 - b. Advanced liver disease.
 - c. Patients positive for HIV, HBsAg & HCV.
 - d. Failed transplant.
 - e. Poisoning cases.
 - f. Pregnancy.
2. Dialysis in infants & children.
3. Special dialysis procedures:
 - a. Continuous therapies in hemodialysis.
 - b. Different modalities of peritoneal dialysis.
 - c. Haemodiafiltration.
 - d. Hemoperfusion.
 - e. SLED.
 - f. MARS.
4. Plasmapheresis
5. Special problems in dialysis patients:
 - a. Psychology & rehabilitation.
 - b. Diabetes
 - c. Hypertension.
 - d. Infections.
 - e. Bone diseases.
 - f. Aluminum toxicity.
6. Renal anemia management: chronic dialysis.

BSc.DTT Directed Clinical Education – part IV (studentship)

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 nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

Applied Dialysis Therapy Technology – Part III

1. Vascular access for hemodialysis & associated complications.
2. Peritoneal access devices: types of catheter, insertion techniques & associated complications.
3. Complications of dialysis:
 - a. Hemodialysis: acute & long term complications.
 - b. Peritoneal dialysis: mechanical & metabolic complications.
4. Peritonitis & exit site infection.
5. Recent advances and research in hemodialysis.
 - a. Nocturnal dialysis.
 - b. Online dialysis.
 - c. Daily dialysis.

6. Telemedicine in dialysis practice.
7. Introduction to kidney transplantation immunology, procedure and Immunosuppressive medications.
8. Live donor and cadaver transplantation; paired exchange transplantation and ABO incompatible transplantation; transplant in sensitized recipients.

Practical

1. Setting up dialysis machine for dialysis.
2. A V cannulation.
3. A V fistula/A V graft cannulation
4. Initiation of dialysis through central venous catheters like internal jugular, femoral & subclavian vein.
5. Packing & sterilization of dialysis trays.
6. Closing of dialysis.
7. Preparation of concentrates depending on the situations.
8. Reuse of dialysis apparatus.
9. Isolated ultrafiltration.
10. Performance of peritoneal dialysis exchange manually.
11. Setting up of automated peritoneal dialysis equipment.
12. First assistant in minor procedures.
13. Skin suturing.
14. CPR demonstrations.
15. Introduction to tissue typing laboratory and witness metrology for 1) HLA typing methods, tissue cross-match (X-match), panel reactive antibodies (PRA) and Detection of donor specific antibodies (DSA).

BSc.DTT Directed Clinical Education – part V (studentship)

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 nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

Seventh and Eighth Semester

Internship

The internship will span 1 year/ 2 semesters. This will include 8 hours of practice a day, totaling to 1440 hours for two semester.

As a part of this, the students will choose a relevant subject and prepare an in-depth project report of not less than 1000 words which will be handed over to the supervisor or trainer. The report can include objective, scope of the project and an in-depth report.

The internship time period provides the students the opportunity to continue to develop confidence and increased skill in simulation and treatment delivery. Students will demonstrate competence in beginning and intermediate procedures. Students will observe the advanced and specialized treatment procedures. The student will complete the clinical training by practicing all the skills learned in classroom and clinical instruction. The students are expected to work for minimum 8 hours per day and this may be more depending on the need and the healthcare setting.

Skills based outcomes and monitorable indicators for Dialysis Therapy Technologist

Competency statements

1. Demonstrate ability to formulate and implement a plan for examination
2. Demonstrate ability to manage acute emergent complications on dialysis
3. Perform peritoneal dialysis
4. Administer medications under the supervision of nephrologist
5. Demonstrates ability to provide safe and effective care to the individual
6. Understands the process of operating dialysis equipment and how to perform alternate dialysis procedures.
7. Assesses the patient for any complications with an understanding of the problem and recognizes the need to report the complications to the physician or nephrologist
8. Responds effectively to the physical and emotional needs of the patient undergoing dialysis treatment
9. Demonstrates a sensitive and caring attitude towards the patient
10. Demonstrates knowledge and ability to operate and maintain all equipment in the dialysis unit.
11. Communicates relevant information to other members and completes accurate documentation
12. Demonstrates ability to correctly position the patient
13. Demonstrates professional behavior

S. No.	Learning outcomes	Knowledge/comprehension	Applications / synthesis / evaluation	Hours
1	Formulation and implementation of an examination plan	Knowledge of vascular access procedures and tests which will efficiently provide the information required for diagnosis	Determines tests and procedures appropriate to the patient's condition and abilities with nephrologist, performs the tests and progressively modifies them (if needed) on the basis of findings	300
2	Managing acute emergent complications on dialysis	Knowledge of allergic reactions to medication	Responds properly to patient complaints and takes appropriate measures including emergency termination of dialysis if needed	300
3	Performs peritoneal dialysis	Knowledge and understanding of the principles of peritoneal dialysis and the different types of PD	Ability to assess a patient for PD, troubleshoot PD problems, prepare for and initiate peritoneal dialysis therapy	400

S. No.	Learning outcomes	Knowledge/comprehension	Applications / synthesis /evaluation	Hours
4	Administration of medication under the supervision of nephrologists	Knowledge of documenting the administration of medications on flow sheet and use of proper aseptic techniques to prepare and administer medications	Recognizes signs and symptoms of adverse reactions; properly administers drugs as prescribed by the doctors during, before and after dialysis procedure; provides adequate education to patients on various medications used	300
5	Provides safe and effective care to the individual	Factual knowledge of the principles of dialysis; hemodialysis preparations, methods and techniques; and quality control measures	Demonstrates appropriate use of barrier precautions and cleaning and disinfection procedures	250
6	Understands the process of operating dialysis equipment and how to perform alternate dialysis procedures	Determines tests and procedures appropriate to the patient's condition and abilities, with nephrologist	Formulates an examination plan based on the patient history	300
7	Assesses the patient for any complications with an understanding of the problem and recognizes the need to report the complications to the physician or nephrologist	Knowledge of possible complications and ways to treat them, ability to recognize dialyzer reaction and involve appropriate supervisory support if needed	Responds properly to patient complaints and takes appropriate measures including emergency termination of dialysis if needed	300
8	Responds effectively to the physical and emotional needs of the patient undergoing dialysis treatment	Ensures a structured, efficient, rational and comfortable exchange of information	Communicates with the patient taking into account his/her physical, emotional, intellectual and cultural background	100
9	Operation and Maintenance of all equipment	Factual knowledge of the appropriate system start up procedure and alarm systems function test	Performs basic operator troubleshooting, appropriately initiates, monitors and terminates chemical disinfect procedure for machine, dialyser and tubing. Instructs and supervises the dialysis technician.	90
	TOTAL			2340

4.3 Master of Science in Renal Science and Dialysis Therapy Technology (MSc.DTT)

Introduction:

The Masters of Science in Renal Science and Dialysis Therapy Technology (MSc.DTT) is specifically aimed at those pursuing a professional career in Dialysis Therapy Technology. It is designed to provide specialized training both in basic scientific principles of modern Dialysis Therapy Technology and in the application of these principles to the understanding of a wide variety of renal-uro disorders. It is designed as a higher degree course suitable for graduates having some experience in dialysis therapy technology.

It is designed to provide training for a future career in research in basic and clinical renal science. The course aims to enhance the scientific skills of clinicians and to provide non-clinical graduates with insight into clinical problems that will allow them to work alongside clinicians in clinical research projects.

Learning Objectives:

Upon successful completion of the Masters' course, students will have developed a broad knowledge of the contribution of basic renal scientific mechanisms to clinical disorders of the excretory system. In particular they will:

1. Understand how mechanisms operating at the molecular, cell, network and system sub-level serve normal function and how damage or dysfunction at these different levels produces specific disorders of importance to clinical dialysis therapy.
2. Have a good working knowledge of modern methods for scientific and clinical investigation of the human excretory system.
3. Be aware of the major recent developments in research in the area of clinical dialysis therapy.
4. Be able to embark upon a successful career in their chosen direction of advanced nephro-research.

Expectation from the future graduate in the providing patient care

1. The primary goal of the Master of Science in Dialysis Therapy Technology program is to prepare accomplished professionals in Dialysis Therapy Technology with a specific emphasis on clinical skills and technical knowledge along with professional research.
2. Trainees acquire the research based knowledge and procedural skills necessary to deliver a high standard of care to the patients with chronic kidney disease requiring renal replacement therapy.
3. This course involves all aspects of care for patients undergoing chronic hemodialysis and continuous ambulatory peritoneal dialysis (CAPD).
4. Overall goal of this training is to foster the trainee's development into an independent care provider and researcher in the field of dialysis.
5. The program intends for its post graduates to contribute to a new generation of academic dialysis professional equipped to address the challenging problems in renal replacement therapy.

Eligibility for admission:

1. B. Sc. (Dialysis Therapy Technology)
2. M.B.B.S
3. B.D.S
4. B. Sc. (Allied Health Sciences)
5. B. Sc. Nursing
6. BVSC

Duration of the course

Duration of the course: 2 years or 4 semesters. (980 hours of Theory & 1180 hours of Practical Classes) and mandatory submission of research thesis.

Total hours - 2160

Medium of instruction:

English shall be the medium of instruction for all the subjects of study and for examination of the course.

Attendance:

A candidate has to secure minimum -

1. 75% attendance in theoretical
2. 80% in Skills training (practical) for qualifying to appear for the final examination.

No relaxation, whatsoever, will be permissible to this rule under any ground including indisposition etc.

Assessment:

As per the existing university rules. **Marks qualifying for a pass**

For University examination subjects:

50% in internal assessment, 50% in university theory examination, 50% in university practical examination and 50% in aggregate

For thesis and defence:

50% in aggregate

Model Curriculum Outline

First Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
MSc.DTT-001	Anatomy paper (Basic anatomy /Nephroanatomy / Embryology/ Histology / Histotechniques)	90	50	140
MSc.DTT -002	Physiology (General physiology/ Nephrophysiology /Endocrinology)	80	50	130
MSc.DTT -003	Biochemistry	40	25	65
MSc.DTT -004	Nephrogenetics/Molecular biology	40	25	65
MSc.DTT -005	Microbiology	40		40
	Residency – part I		100	100
	TOTAL	290	250	540

Second Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
MSc.DTT -006	Nephropathology/Nephro-Immunology	75	30	105
MSc.DTT -007	Pharmacology	60	30	90
MSc.DTT -008	Research Methodology	80	30	110
MSc.DTT -009	Biophysics/Biomedical Instrumentation	65	-	65
MSc.DTT -010	Biostatistics	50	-	50
	Residency – part II		120	120
TOTAL		330	210	540

Third Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
MSc.DTT -011	Nephrology & Kidney disease	75	125	200
MSc.DTT -012	Emergency medicine/ACLS/Renal Nutrition	70	40	110
MSc.DTT -013	Nephro- Radiological and imaging sciences	50	40	90
	Residency – part III		140	140
TOTAL		195	345	540

Fourth Semester

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
MSc.DTT -014	Recent Advances in Dialysis & Nephrology	75	135	210
MSc.DTT -015	Renal transplantation and coordination/Psychology	50	40	90
	Residency - part IV – Project / Thesis/ Dissertation	40	200	240
TOTAL		165	375	540

First Semester

Human anatomy

A. Anatomy

1. Anatomical Terminology: Descriptive anatomical terms, terms related to movement and position
2. Skeletal system
 - a. Name and parts of the Bone and joints
 - b. Skeleton, skull, vertebrae, pelvis, ribs, bones of extremities, principal joints
 - c. Lumbar vertebra and pelvis in detail
3. Muscular system – Classification, Types, Attachment, Action and nerve supply of the Muscles of Abdomen and Pelvis
4. Cardiovascular system – Heart and Major Blood Vessels, Abdominal Aorta and its Branches In detail, Inferior vena cava and its tributaries.

Pericardium: Fibrous pericardium, serous pericardium, Pericardial sinuses

Heart: Surfaces of the heart, Borders of the heart, chambers of the heart right atrium, right ventricle, left atrium, and left ventricle

- a. Structure of the heart
 - b. Conducting system of the heart,
 - c. Arterial supply of the heart
 - d. Blood supply of the conducting system
 - e. Venous drainage of the heart
 - f. Nervous supply of the heart
 - g. Value of the heart
5. Respiratory system – Pleura, Lungs
Mediastinum - Superior mediastinum, Inferior Mediastinum.
Pleura – Nerve supply of the Pleura
Trachea – Nerve supply to the Trachea
Principal Bronchi
Lungs:- Lobes and Fissures – Right Lung, Left lung
Broncho pulmonary Segments-
Right Lung: Superior Lobe
Middle Lobe
Inferior Lobe
Left Lung: Superior Lobe
Inferior Lobe
Blood Supply to the lungs
Lymph drainage of the lungs
Nerve supply of the lungs
6. Nerve supply of Abdomen and pelvis
 7. Lymphatics of Abdomen and pelvis
 8. Peritoneal Cavity – Peritoneum, Folds and Recesses
 9. Urinary system: Organs – Kidney, Ureter, Bladder and Urethra
 10. Endocrine organs
 11. Male Reproductive system
 12. Female Reproductive system
 13. Development of urogenital system
 14. Microanatomy of urinary system
 15. Regional – Cubital Fossa, Inguinal canal, Femoral Triangle and Adductor canal.

B. Histology

1. T.S of a human kidney
2. Photomicrograph of part of the renal cortex
3. Photomicrograph of the blood supply to the kidney cortex
4. Photomicrograph of the renal corpuscle
5. Microscope of the visceral epithelium
6. Microscope of a peripheral portion of a Renal corpuscle
7. Electron microscope filtration barrier
8. Diagram of a lobule of glomerular capillaries
9. Juxta glomerular complex
10. Renal cortex
11. Renal cortex
12. Renal cortex showing the proximal convoluted tubule and distal convoluted tubule
13. Proximal convoluted tubule
14. Renal medulla
15. Renal papilla
16. Distal convoluted tubule

17. Collecting tubule
18. Deep cortical area and outer medulla
19. Kidney cortex the JG apparatus
20. Kidney Medulla – papilla
21. Papilla adjacent to a calyx, longitudinal
22. TS of ureter
23. Ureter wall TS
24. Urinary bladder TS
25. Urinary Bladder mucosa

Physiology:

1. Introduction to physiology:
 - a. The cell and general physiology-Functional organization of the human body and control of the “Internal Environment”-Homeostasis-Regulation of body functions
 - b. The cell and its function-Physical structure of the cell-Functional systems of the cell
 - c. Genetic control of protein synthesis, cell function and cell reproduction-RNA-Cell differentiation
2. Temperature regulation:
 - a. Metabolism carbohydrates – formation of adenosine triphosphate-free energy-role-metabolism-glucose metabolism-storage-lysis-glycolytic pathway-formation of pyruvic acid-citric acid-formation of ATP-breakdown of glucose-release of energy-anaerobic glycolysis-pentose phosphate pathway-glucose conversion to fat-formation of carbohydrates-Blood glucose-Lipid metabolism-Transport of lipids-Transport of fatty acid-Lipoproteins-fat deposits-adipose tissue-liver-lipids-use of triglycerides-synthesis-regulation of energy-release-phospholipids-cholesterol-atherosclerosis-protein metabolism-amino acids-storage-metabolic roles in plasma-essential and non-essential
 - b. -use of proteins and energy –degradation of proteins-Hormonal regulation of protein metabolism-liver-metabolic functions-carbohydrate-fat protein – excretion of bilirubin in the bile-vitamins –energetic and metabolic rate -Body temperature-Heat production & loss- role of hypothalamus- neuronal effector mechanism-body temp-behaviour control-local skin temperature-Fever-Exposure to cold.
3. Nephro Endocrinology
 - a. Introduction to endocrinology
 - b. The pituitary hormones and their control by the hypothalamus: The pituitary Gland and its relation to the hypothalamus – control of pituitary secretion by the hypothalamus – physiological functions of growth hormone – The posterior pituitary gland and its relation to the hypothalamus
 - c. The thyroid metabolic hormones: Formation and secretion of the thyroid hormones – functions of the thyroid hormones in the tissues – regulation of thyroid hormone secretion – disease of the thyroid. The adrenocortical Hormones: Chemistry of Adrenocortical secretion – Functions of the mineralocorticoids-aldosterone – Functions of the glucocorticoids – The adrenal androgens – Abnormalities of adrenocortical secretion. Insulin, Glucagon and diabetes mellitus: Insulin and its metabolic effects Glucagon and its functions – somatostatin – hyper-insulinism. Parathyroid hormone, Calcitonin, calcium and phosphate metabolism, vitamin D, Bone and Teeth: calcium and phosphate in the extracellular fluid and plasma-function of Vitamin D – Bone and its relationships to extracellular calcium and phosphates – parathyroid hormone – calcitonin – overall control of calcium Ion concentration – physiology of parathyroid and bone diseases.
4. Kidneys and body fluids
 - a. The body fluid compartments : extracellular and intracellular fluids interstitial fluid and edema

- Body fluid compartments
 - Constituents of extracellular and intracellular fluids
 - Osmotic equilibria and fluid shifts between the extracellular and intracellular fluids
 - Changes in the volumes and osmolality of the extracellular and intracellular fluid compartments in abnormal states
 - Edema fluids in the potential spaces of the body
- b. Formation of urine by the kidney: Renal Blood Flow, Glomerular filtration and their control.
- physiologic anatomy of the kidney
 - Basic theory of nephron function
 - Renal blood flow and pressures
 - Glomerular filtration and the glomerular filtrate
 - Control of the glomerular filtration rate and renal blood flow
 - Reabsorption of fluid by the peri-tubular capillaries
- c. Formation of urine by the kidney: Processing of the filtrate in the tubules
- effect of tubular load and tubular transport maximum on urine constituents
 - the concept of Plasma Clearance its use in assessing renal function
- d. Renal associated mechanism for controlling extracellular fluid osmolality and sodium concentration
- The mechanism for excreting excess water: Excretion of a dilute urine
 - The mechanism for excreting excess solutes: The countercurrent mechanism for excreting a concentrated urine
 - Control of extracellular fluid osmolality and sodium concentration
 - Sodium excretion and its control by aldosterone
- e. Renal regulation of Blood volume and extracellular fluid Volume: Excretion and regulation of urea, potassium, and other substances
- control of blood volume
 - control of extra cellular fluid volume
 - urea excretion
 - Potassium excretion
 - Control of the extracellular concentrations of other ions
- f. Regulation of Acid-Base Balance
- Function of Acid – Base Buffers
 - Respiratory regulation of Acid – Base balance
 - Renal control of Hydrogen Ion concentration
 - Clinical abnormalities of Acid-Base Balance
- g. Renal Disease, Diuresis, and Micturition
- Renal Disease
 - Renal Function tests
 - Diuretics and mechanisms of their actions
 - Micturition

Biochemistry:

1. Carbohydrates-Classification- Monosaccharides- Structure of glucose-Disaccharides- reactions of sugar-Phosphoric esters-Poly saccharides.

2. Lipids-Classification-Simple-fats-waxes- fatty acids-glycerol-compound lipids-steroids-cholesterol-bile acids-steroid hormones.
3. Proteins-Classification-hydrolysis-denaturation-precipitation-coagulations-classification of amino acids & reaction-chromatography-electrophoresis-architecture of protein molecules
4. Enzymes-Classification-mechanism-coenzymes-mechanism of action-factors-clinical interest.
5. Vitamins-Fat-soluble-Vitamin A-D-E-K- water soluble –Vitamin B-complex & Vitamin C
6. Nucleoproteins & Nucleic acids-Metabolism-nucleotides-Nucleosides-Nucleic acids
7. Porphyrins & bile pigments-chemistry-metabolism-porphyrins
8. Hemoglobin-Chemistry-metabolism-formation-circulation-jaundice-hemoglobinopathies.
9. Blood & Cerebrospinal fluid-coagulation of proteins-immunoglobulins
10. Chemistry of respiration-diffusion of gases-in the lungs-transport of oxygen in blood-oxygen dissociation curve-carbon dioxide dissociation curve.
11. Changes undergone by Foodstuffs in the alimentary tract-Digestive enzymes & their action bile-Putrefaction
12. De-toxication mechanisms-De-toxication – oxidation – reduction-hydrolysis-conjugation
13. Acid base balance-buffer system –effect of carbon dioxide on blood pH-hemoglobin buffer system-regulation by respiratory mechanism, renal mechanism-acidosis-alkalosis-methods of investigating intermediary mechanism-general methods- isotope methods
14. Biological oxidation oxidative reduction electron transport chain-bioenergetics system-high energy phosphate system.
15. Metabolism of carbohydrates- aerobic & anaerobic metabolic metabolism of glucose-Role of liver in carbohydrate metabolism-alternate aerobic pathway-Role of carbohydrate metabolism-Alternate aerobic pathway-pentose-muscle contraction-regulation of blood sugar-metabolism of other hexoses.
16. Lipid metabolism-Introduction-Blood lipids-absorption-oxidation of fatty acids-synthesis-energetic of fat metabolism- metabolism of cholesterol.
17. Protein metabolism-Absorption-storage-general pathway-nitrogen metabolism-anabolism-catabolism-Metabolism of amino acids
18. Energy metabolism-Measurement of energy-basal metabolism-caloric requirement –well balanced diet-elements of nutrition.
19. Water & Mineral Metabolism-Sodium – potassium- chloride-Sulphur-calcium-phosphorus-magnesium-Ion Iodine copper-Zinc etc.
20. Hormones-Thyroxine-parathyroid hormone-Insulin-glucagon-adrenal hormones-adrenal medullary hormones-Hormones of adrenal cortex-Sex hormone-pituitary hormone.
21. Regulation of pH of Blood and body fluids: Regulatory mechanisms, Renal Mechanism, Disturbances in acid-base balance, respiratory acidosis , respiratory alkalosis, metabolic acidosis, metabolic alkalosis, assessment of the acid- base balance, carbon-di-oxide combining power of blood, alkali reserve, anion gap, Evaluation of Acid –Base balance
22. Renal function Formation and composition of urine – Specific gravity and pH, solids and 24 hour urine, abnormal constituents of urine- Glycosuria - glycosuria, fructosuria, pentosuria, lactosuria, galactosuria. Proteinuria, Ketone bodies, Bile pigments and bile salts, Blood, porphyrins, Urinary lithiasis.
23. Function & Test of Liver
24. Elements of Biochemical genetics & inborn errors of metabolism.

Nephrogenetics and Molecular biology:

A. Nephrogenetics: Introduction to Human Genetics

1. Introduction: Structure and function of the cell, cell organelles, DNA structure, function, replication and synthesis, RNA structure and function, classification, protein synthesis, post translational modifications, structure and function of Eukaryotic genes and genome. Cell culture, fixing and staining techniques. Genes involved in apoptosis and reproductive cell

- death. Instrumentation: principles of microscopy, staining techniques and classification of staining dyes, fluorescence dyes and principles of cheme-luminense.
2. Transmission Pattern and Genetic Variation: Principles of Mutations and types, detection of various mutations, population variations, polymorphisms, basic concepts of formal genetics. Inheritance pattern, consanguinity in Human population, mitochondrial gene and inheritance, role of environment hazards, pollution and teratogens. Nuclear and chemical accidente and impact on environment. Regulatory bodies involved in pollution and genetics toxicology. Genetic counseling: principles and ethics in dealing with genetic disorders and treatment. Fetal treatment and gene therapy.
 3. Clinical Genetics: Principal and practice of clinical genetics, congenital defects, single gene disorders, multifunctional disorders, and genetic disorders associated with various organs, transmission pattern(Mendelian, non-Mendelian, risk assessment, twin studies, and sex linked and influenced inheritance). Inborn errors of metabolism (transmission pattern, classification), prenatal diagnosis and pre – implantation genetics. Types of in-vitro fertilization methods and application in clinic. POSSOM software and computer assisted genetic diagnosis. Photodynamic therapy. Immunogenetics: Basic concepts of Immune response, HLA compatibility and transplantation medicine (Genetics of Bone marrow transplantation, cord blood and stem cell therapy). Immunodeficient disorders, Genetics of Blood group, rare blood groups and inheritance pattern basic principles of immunotherapy. Pharmacogenetics: Basic principles, genetic basis of drug with reference to sex, race and gene regulated metabolism, G6PD disorders.
 4. Cytogenetic: Molecular structure of human chromosomes, Types of human DNA and function, Cytogenetic Technology and Nomenclature (ISCN 1985-2002). Chromosome abnormalities (Numerical, structural, sub-telomeric, Cryptic translocations, chromosome polymorphisms). Diseases associated with chromosome abnormalities. Banding pattern: types, principles, types and application. Chromosome Instability syndrome, Genetics of bone marrow transplantation, HLA typing, G6PD disorder, principles of Pharmacogenetics.
 5. Cancer Genetics: Genetic basis of malignant transformation, metastasis, cancer cytogenetics and interphase cytogenetics, application of FISH in cancer diagnosis and prognosis. Cellular and molecular basis of pre-cancerous lesions, malignant transformations, metastasis, inherited cancer genes. Chemotherapy, mode of action of chemotherapeutic drugs, radiation for radiotherapy, # D treatment planning system, fractionation and therapeutic protocols. Cellular and Molecular events associated with Cell Cycle regulation, growth factors, cytokines classification and their role in cell cycle regulation. Proto-oncogene, oncogenes and tumor suppressor genes. Genetic screening for predisposition of cancer, premalignant lesions, inheritance patterns in various Cancers, chemoprevention, molecular signals involved in angiogenesis, metastasis. Immunotherapy: Basic principles.
 6. Molecular genetics and Diagnosis: General principles and practice of molecular diagnosis, Gene mapping, DNA sequencing (automatic and manual methods), Principles and types of PCR diagnosis and principles of Micro array technology. Molecular diagnosis of prenatal and pre-implantation genetic diagnosis. Molecular tools for screening for genetic disorders. Mutation analysis: Basic principles and classification. General principles of southern, northern and western blotting.

B. Molecular biology

1. Introduction
2. Concept
3. Basic principles of Biotechnology
4. Recombinant DNA technology
5. Gene therapy
6. Biology & classification of Cloning strategies & Vectors.
7. Site Directed Mutagenesis.
8. Introduction of genes into the cell

9. Antibody antigen reaction,
10. Hybridoma
11. Vaccines production (Principles)
12. DNA modifying enzymes and DNA synthesis
13. Antisense Technology
14. Stem cell research: principles and application
15. Identification of the Genetic materials
16. Chemical Nature of Genetic Materials
17. Replication of DNA
18. Non –Genetic Ribonucleic Acid (RNA) and Transcription
19. Genetic code
20. Protein synthesis
21. Regulation of Gene Action
22. Genetic Engineering(Isolation, sequencing, Synthesis of Gene and DNA Fingerprinting)
23. Immunology
24. Genetic Recombination and Gene Transfer (Bacterial Conjugation, Transformation, Transduction, Episomes and Plasmids)

Practical:

1. Cell culture and staining techniques
2. Microscopy
3. Fluorescence technique
4. Chromosome preparation and analysis
5. DNA isolation and Quantitation
6. Restriction enzyme digestion
7. PCR protocols
8. Gel electrophoresis
9. Gel documentation System
10. Immunogenetics technique
11. Pharmacogenetics technique
12. Cancer Genetics protocols
13. Image Analysis System

Microbiology:

General Bacteriology

1. Glossary of microbiology
2. History and scope
3. Morphology of bacteria
4. Nutritional requirements of bacteria
5. Bacterial metabolism
6. Media for bacterial growth
7. Classification and identification of bacteria
8. Sterilization and disinfection
9. Infection
10. Antimicrobial therapy

Systematic Bacteriology

General character, Classification – its morphology, cultural characteristics, factors influencing pigment production, chemical reactions, characteristics of pathogenic stain, enzymes produced, toxin, lab diagnosis for

1. Staphylococcus
2. Streptococcus

3. Pneumococcus
4. Neisseria
5. Corynebacterium
6. mycobacteria
7. Bacillus
8. Clostridium
9. Enterobacteriaceae
10. pseudomonas
11. Vibrio
12. Brucella
13. Pasteurella, Yersinia & Francisella
14. Hemophilus
15. Bordetella
16. Spirochaetes
17. Miscellaneous bacteria
18. Rickettsiae
19. Chlamydiae
20. Newer bacteria, microbiology of oral cavity.

Virology

1. General character of viruses
2. Chemotherapy of viral diseases
3. Classification of viruses
4. Oncogenic viruses
5. Acquired Immune Deficiency syndrome
6. DNA viruses
7. RNA viruses
8. Miscellaneous Viruses

Mycology

Clinical Microbiology

1. Collection and transport of clinical specimens
2. Collection and preliminary processing of specimens
3. Diagnostic microbiology – An approach to lab diagnosis
4. Rapid and automation methods in diagnostic microbiology
5. Serological and skin tests
6. Community microbiology
7. Nosocomial infections
8. Diagnostic virology
9. Emergency microbiology

Residency part – I

In the residency the professional is expected to work and contribute in the dialysis therapy technology unit.

Second Semester

Nephropathology and Nephro Immunology

A. Nephropathology

1. Congenital Anomalies

- a. Cystic Diseases of the kidney
 - b. Cystic Renal Dysplasia
 - c. Autosomal Dominant(Adult) Polycystic Kidney Disease
 - d. Autosomal Recessive (Childhood) Polycystic Kidney Disease
 - e. Cystic Diseases of Renal Medulla
 - Medullary sponge kidney
 - Nephronophthisis-Uremic Medullary Cystic Disease Complex
 - f. Acquired (Dialysis –Associated) Cystic Disease
 - Simple cysts
2. Glomerular Diseases
- a. Clinical manifestations
 - b. Histologic alterations
 - c. Pathogenesis of Glomerular injury
 - In situ Immune Complex Deposition
 - Anti-GBM Nephritis
 - Heyman Nephritis
 - Antibodies against Planted Antigens
 - Circulating Immune Complex Nephritis
 - Antibodies to Glomerular Cells
 - Cell-Mediated Immunity in Glomerulonephritis
 - Activation of Alternative Complement Pathway
 - Epithelial Cell Injury
 - Mediators of Glomerular injury
 - Cells
 - Soluble Mediators
 - Mechanisms of progression in Glomerular Disease
 - Acute Glomerulonephritis
 - Acute Proliferative(Post streptococcal, Post infectious) Glomerulonephritis
 - Post streptococcal Glomerulonephritis
 - Non streptococcal Acute Glomerulonephritis
 - d. Rapidly Progressive (Crescentic) Glomerulonephritis
 - e. Nephrotic Syndrome
 - f. Membranous Glomerulonephritis (Membranous Nephropathy)
 - g. Minimal Change Disease (Lipoid Nephrosis)
 - h. Focal Segmental Glomerulosclerosis
 - i. Membrano-proliferative Glomerulosclerosis
 - j. IgA Nephropathy (Berger Disease)
 - k. Focal Proliferative And Necrotizing Glomerulonephritis
 - l. (Focal Glomerulonephritis)
 - m. Hereditary Nephritis
 - Alport syndrome
 - Thin Membrane Disease (Benign familial Hematuria)
3. Chronic Glomerulonephritis
- a. Glomerular Lesions Associated With Systemic Disease
 - Systemic Lupus Erythematosus
 - Henoch-Schonlein Purpura
 - Bacterial Endocarditis
 - Diabetic Glomerulosclerosis
 - Amyloidosis
 - Fibrillary and Immunotactoid Glomerulonephritis
 - Other Systemic Disorders

- b. Diseases Affecting Tubules And Interstitium
 - Acute Tubular Necrosis
 - Tubulointerstitial Nephritis
 - Pyelonephritis and Urinary Tract Infection
 - Acute Pyelonephritis
 - Chronic Pyelonephritis and Reflux Nephropathy
 - Tubulointerstitial Nephritis Induced by Drugs and Toxins
 - Acute Drug-Induced Interstitial Nephritis
 - Analgesic Abuse Nephropathy
 - Nephropathy Associated with Nonsteroidal Anti-Inflammatory
 - Drugs
 - Other Tubulointerstitial Diseases
 - Urate Nephropathy
 - Hypercalcemia and Nephrocalcinosis
 - Multiple Myeloma
- 4. Diseases of Blood Vessels
 - a. Benign Nephrosclerosis
 - b. Malignant Hypertension And Accelerated Nephrosclerosis
 - c. Renal Artery Stenosis
 - d. Thrombotic Microangiopathies
 - e. Classic (Childhood) Hemolytic-Uremic Syndrome
 - f. Adult Hemolytic-Uremic Syndrome/Thrombotic Thrombocytopenic Purpura
 - g. Other Vascular Disorders
 - h. Atherosclerotic Ischemic Renal Diseases
 - i. Sickle Cell Diseases Nephropathy
 - j. Diffuse Cortical Necrosis
 - k. Renal Infarcts
- 5. Urinary Tract Obstruction (Obstructive Uropathy)
- 6. Urolithiasis (Renal Calculi, Stones)
- 7. Tumors Of The Kidney
 - a. Benign Tumors
 - Renal Papillary Adenoma
 - Renal Fibroma or Hematoma (Renomedullary Interstitial Cell Tumor)
 - Angiomyolipoma
 - Oncocytoma
 - b. Malignant Tumors
 - Renal Cell Carcinoma (Hypernephroma, Adenocarcinoma of Kidney)
Classification of Renal Cell Carcinoma: Histology, Cytogenetics, and Genetics
 - Urothelial Carcinomas of Renal Pelvis

Practical:

1. Acute Proliferative(Post streptococcal, Post Infectious) Glomerulonephritis
2. Rapidly Progressive (Crescentic) Glomerulonephritis
3. Focal Segmental Glomerulosclerosis
4. Membrano-proliferative Glomerulosclerosis
5. IgA Nephropathy (Berger Disease)
6. Focal Proliferative And Necrotizing Glomerulonephritis (Focal Glomerulonephritis)
7. Chronic Glomerulonephritis
8. Glomerular Lesions Associated With Systemic Disease
 - a. Systemic Lupus Erythematosus
 - b. Diabetic Glomerulosclerosis

- c. Amyloidosis
- d. Acute Tubular Necrosis
 - Acute Pyelonephritis
 - Chronic Pyelonephritis and Reflux Nephropathy
- e. Acute Drug-Induced Interstitial Nephritis
 - Analgesic Abuse Nephropathy
 - Multiple Myeloma
- f. Benign Nephrosclerosis
- g. Malignant Hypertension and Accelerated Nephrosclerosis
 - Renal Infarcts
 - Angiomyolipoma
 - Oncocytoma
 - Urine routine/ME

B. Nephro-Immunology

Nature of the Immune system

1. Historical concepts and introduction to serological testing:
 - a. Immunity and immunization
 - Cellular versus humoral immunity
 - Antigens and haptens
 - Cells – mediated immunity
 - b. The Age of serology
 - c. Other historical developments

2. Natural Immunity:
 - a. External defense system
 - b. Internal defense system
 - cellular Defense mechanism
 - acute phase reactants
 - inflammation
 - c. Summary

3. The lymphoid system:
 - a. Primary lymphoid organs
 - Bone marrow
 - Bursa of fabricius
 - Thymus
 - b. Secondary lymphoid organ
 - Spleen
 - Lymph nodes
 - Other secondary organs
 - c. Surface marker on lymphocytes
 - d. Stages in B-cell differentiation
 - Pro- B cells
 - Pre – B cells
 - Immature B cells
 - Mature B cells

- Activated B cells
 - Plasma cells
 - e. T cells Differentiation
 - Double – negative stage
 - Double positive stage
 - Mature T cells
 - Antigen activation
 - f. Third population or natural killer
 - Mechanism of cyto toxicity
 - Antibody – Dependent cell
 - g. Laboratory identification of lymphocytes
 - Fluorescence Microscopy
 - Cell flow cytometry
 - Other methods
 - h. Summary
4. Nature of Antigens and the MHC Complex
- a. Factors influencing the immune response
 - b. Traits of Immunogens
 - c. Nature of epitopes
 - d. Haptens
 - e. Relationship of antigens to the Host
 - f. Adjuvants
 - g. Major Histocompatibility Complex
 - Genes coding for the HLA antigens
 - Class I Antigens
 - Class II antigens
 - Antigen presentation
 - MHC and Autoimmunity
5. Antibody structure and Function:
- a. Tetra peptide structure of immunoglobulin
 - Cleavage with papain
 - Pepsin digestion
 - b. The Nature of Light Chains
 - c. Heavy chain sequencing
 - d. Antigen recognition unit
 - e. Hings region
 - f. IgG
 - g. IgM
 - h. IgA
 - i. IgD
 - j. IgE
 - k. Theories of antibody diversity
 - l. Genes coding for immunoglobin
 - m. Monoclonal antibody

- n. Summary
6. Cell-Mediated Immunity:
 - a. Activation of T Helper cells
 - Adhesion Molecules
 - Specific Antigen recognition
 - Function of Interleukin-2
 - Triggering of Interleukin-1
 - T- Helper subsets
 - b. Stimulation of B cells
 - c. Activation of cytotoxic T cells
 - Role of cytokines in the inflammatory response
 - I-1, I-2, I-3, I-4, I-5, I-6, Other I , Interferon's, TNF, other factors
 - d. Laboratory determination of T lymphocyte function
 - Summary
 7. Complement:
 - a. The classic pathway
 - The recognition unit
 - The activation unit
 - The membrane attack
 - b. The alternative pathway
 - c. System controls
 - fluid phase regulators
 - cell – bound regulators
 - e. Other cell membrane Receptors
 - f. Biologic manifestation of complement activation
 - g. Complement and Diseases states
 - h. Complement Deficiencies
 - Paroxysmal Nocturnal Hemoglobinuria
 - Other complement
 - Laboratory detection of complement abnormalities
 - summary
 8. Transplantation:
 - a. Review of MHC
 - b. Transplantation
 - Descriptive terms
 - Graft rejection
 - Tissue matching
 - Types of tissues and organs transplanted
 - Prevention and treatment of rejections

Pharmacology

1. General Pharmacological principle
 - a. Definitions, routes of drug administration
 - b. Pharmacokinetics
 - c. Pharmacodynamics

- d. Adverse drug effects
2. Drugs acting on autonomic nervous system
 - a. ANS – general considerations
 - b. Cholinergic system and drugs
 - c. Anticholinergic drugs and drug acting on autonomic ganglion
 - d. Adrenergic system and drugs
 - e. Antiadrenergic Drugs (adrenergic Receptor antagonist)
3. Autacoids and related drugs
 - a. Histamine and antihistaminic
 - b. 5-Hydroxytryptamine, its antagonists and drug therapy of migraine
 - c. Prostaglandin, leukotrienes (Eicosanoids) and platelet activating factors
 - d. Non-steroidal anti-inflammatory drugs and antipyretic-analgesics
 - e. Additional drugs for rheumatoid arthritis and drugs for Gout
4. Respiratory system drugs
 - a. Drugs for cough and bronchial asthma
5. Hormones and related drugs
 - a. Anterior pituitary Hormones
 - b. Thyroid Hormones and thyroid inhibitors
 - c. Insulin, oral hypoglycemic drugs and glucagons
 - d. Corticosteroids
 - e. Gonadal hormones (sex hormones) and their antagonist
 - f. Oxytocin and drugs acting on uterus
 - g. Drugs affecting calcium balance
6. Drugs acting on peripheral (somatic) Nervous system
 - a. Skeletal muscle Relaxants
 - b. Local Anaesthetics
7. Drugs acting on Central Nervous System
 - a. General anaesthetics
 - b. Ethyl and methyl alcohols
 - c. Sedative-hypnotics
 - d. Antiepileptic drugs
 - e. Anti-parkinsonian drugs
 - f. Drugs used in Mental illness: Antipsychotic and antianxiety drugs
 - g. Drugs used in mental illness: antidepressant and antimanic drugs
 - h. Opioid analgesics and antagonists
 - i. CNS stimulants and cognition Enhancers
8. Cardiovascular drugs
 - a. Cardiac Electrophysiological considerations
 - b. Drugs affecting Renin- Angiotensin system and plasma kinins
 - c. Cardiac glycosides and drugs for CHF
 - d. Antiarrhythmic drugs
 - e. Antianginal and other anti-ischaemic drugs
 - f. Anti-Hypertensive drugs
9. Relevant physiology of urine formation
 - a. Diuretics
 - b. Antidiuretics
10. Drugs affecting blood and blood formations
 - a. Haematinics and erythropoietin
 - b. Drugs affecting coagulation, bleeding and thrombosis
 - c. Hypolipidemic drugs and plasma expanders
11. Gastrointestinal drugs

- a. Drugs for peptic ulcer
 - b. Emetics, antiemetics and other gastrointestinal drugs
 - c. Drugs for constipation and diarrhoea
12. Antimicrobial drugs
- a. Antimicrobial drugs : General consideration
 - b. Sulfonamides, cotrimoxal and quinolones
 - c. Betalactam antibiotics
 - d. Tetracycline and chloramphenical (Broad spectrum antibiotics)
 - e. Aminoglycoside antibiotics
 - f. Macrolide and other antibacterial antibiotics treatment of UTI
 - g. Antitubercular drugs
 - h. Antileprotic drugs
 - i. Antifungal drugs
 - j. Antiviral drugs
 - k. Antimalarial drugs
 - l. Antiamoebic and other antiprotozoal drugs
 - m. Anthelmintics
13. Chemotherapy of neoplastic Diseases
- a. Anticancer drugs
14. Miscellaneous drugs
- a. Immunosuppressants, gene therapy,
 - b. Drugs acting on skin and mucous membranes
 - c. Antiseptics, disinfectants and ectoparasiticides
 - d. Chelating agents
 - e. Vitamin,
 - f. Vaccines and sera

Research Methodology

General Information on science and its inter phase with society-scientific methods and its goal Research Process, criteria of good research, research problem, selecting, defining problems-Hypothesis-research design and sampling design-Data collection-analysis of data-Interpretation -of and report writing-transformation and presentation-preparation of manuscripts-literature collecting-reporting and publishing-library organization- indexing and cataloging-Internet facilities-bibliography-references-sources of literature-(reviews-abstracts-short notes-journal publications-magazines-periodicals)

Preparation of Index cards-writing a scientific paper-citing of reference-foot notes- proof reading-plates etc.-Preparation of research reports-scientific report writing- documentation-preparation of project reports.

- 1. Introduction
 - a. Uses of Statistical methods
 - b. Measurement, Measurement scales
 - c. Variables-Symbolizing data & operation
 - d. Practical application of research studies
- 2. Statistical data
 - a. Tabulation and calculation of measures of central tendency-
 - b. Dispersion-Linear regression & Correlation
 - c. Presentation of data in diagrammatic and graphic form
 - d. Probability & Sampling
 - e. Probability as a Mathematical system

- f. Population & Samples-Sampling distribution
- g. Sampling methods-Surveys in research
- h. Vital Statistics
- i. Point & Interval & Estimation of Mean Hypothesis
- j. Simple test of significance
- k. Inferential Techniques
- l. Vital & Health Statistics
- m. Use of Vital & Health statistics in Renal science
- n. Source & methods of collection & Recording
- o. Computation of commonly used vital & Health statistics
- p. Estimation of population by using arithmetic progression method

3. Research Process methods

- a. Overview-Science & Scientific methods-Research approach
- b. Steps in the research process
- c. Selection & Statement of problems-scientific report of the study
- d. Formulation of Hypothesis
- e. Basic principles & methods of research designs
- f. Data collection methods & scales & Techniques
- g. Reliability-validity and criteria assessing
- h. Measuring the tools
- i. Analysis & Interpretation of research data
- j. Role of computers
- k. Pilot study.-conducting the study
- l. Preparing the research report
- m. Mechanics
- n. Documentation
- o. Details of the study
- p. Arrangement of report
- q. Final presentation

Practical

1. Collection & Identification of Literature-Preparation of Index cards-reprint request cards-Reference manager-
2. Journal club-group discussion-Preparation of abstracts-Drawing a skeleton for a research article-Review article
3. Reproduction of Data-Graphs-Tables-& pictorials-Proof reading.

Biophysics and Biomedical Instrumentation

A. Biophysics

1. Properties of matter
Phases of matter, introduction of atomic structure, properties of atoms and molecules, gas laws, solutions, properties of solutions, ions, properties of ions, PH, buffers, biomolecules and structure of biomolecules.
2. Membranes
Cells, structure of cells, structure of membranes, membrane transport processes, electrical properties of membranes - Structure & Properties of Ion Channels Voltage, Patch Clamp Tech – Synaptic Transmission- NMJ – Signal Transduction – Signaling – Second Messenger – Neural Network – Ion Channels in Brain Pathology.
3. Biophysics of nerve transmission

Membrane potential and its origin, membrane conductance, resistance and capacitance, action potentials, ionic basis of resting membrane potential and action potentials, synaptic transmission, electrophysiological basis for E.E.G., E.C.G & E.M.G recordings, evoked potentials and conduction velocity

Measurements.

4. Biophysics of the cardio vascular system
Basic principles of fluid dynamics, hemodynamics, introduction to principles of electrocardiography & vector cardiography
5. Biophysics of respiration
Mechanics of breathing, lung compliance, airway resistance and their measurement, surface tension & surfactants, partial pressure of gases, principles of gas exchange, measurement of blood gases, pulmonary function tests.
6. Biophysics of renal function
Diffusion, filtration, physical basis for ion, solute and water movement, dialysis, renal function tests.
7. Radiation biophysics
Introduction to nuclear physics and radioactivity, biological effects of radiation, radiation detection and measurement, radioisotopes and their uses.
8. Biophysical techniques
Introduction to microscopic techniques, introduction to spectroscopic techniques, introduction to imaging techniques, introduction to techniques in biophysical chemistry.

B. Biomedical Instrumentation

1. Introduction to Biomedical Instrumentation
 - a. The Age of Biomedical Engineering
 - b. Development of BM instrumentation
 - c. Biometrics
 - d. Introduction to the man-instrument system
 - e. Components of the man-instrument system
 - f. physiological systems of the body
 - g. Problems encountered in measuring a living system.
2. Basic Transducer principles:
 - a. The transducer and transduction principles
 - b. Active transducers
 - c. Passive transducers
 - d. Transducers for Biomedical applications
3. Sources of Bioelectric potentials:
 - a. Resting and action potentials
 - b. Propagation of Action potentials
 - c. The Bioelectric potentials
4. Electrodes
 - a. Electrode theory
 - b. Biopotential electrodes
 - c. Biochemical transducers
5. The computer in Biomedical Instrumentation:
 - a. The digital computer - Computer Hardware, Computer software
 - b. Microprocessors - Types of microprocessors, Microprocessors in Biomedical Instrumentation- Calibration , Table lookup , Averaging , Formatting and printout
 - c. Interfacing the computer and medical instrumentation and other equipment.- Digital interfacing requirement , Analog-to-digital and Digital-to-Analog conversion
 - d. 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

6. Electrical safety of Medical Equipment.
 - a. Physiological effects of electrical current.
 - b. Shock hazards from electrical equipment.
 - c. Methods of accident prevention
 - Grounding
 - Double insulation
 - Protection by low voltage
 - Ground – fault circuit interrupter
 - Isolation of patient – connected parts
 - Isolated power distribution systems
7. Patient care and monitoring:
 - a. The elements of intensive – care monitoring
 - Patient monitoring displays
 - b. Diagnosis, calibration and reparability of patient – monitoring equipment
 - c. Other instrumentation for monitoring patients
 - d. The organization of the hospital for patient care monitoring
 - e. Defibrillator
8. Description of Machine Functions and Malfunction
 - a. Description of the T1Test
 - b. Function description of the s
 - c. Function description of the hydraulic unit
9. Technical safety checks and maintenance
 - a. General notes
 - b. Technical safety checks and maintenance procedures
 - c. VDE test
 - d. TSC and maintenance checklist
10. Adjustment
 - a. Overview of the Dip switches
 - b. Calibration mode
 - c. Hydraulics
 - d. Dir detector
11. Calibration Program
12. Diagnostics Program
 - a. General notes
 - b. Menu structure (TIHMS)
 - c. Reading the analog inputs of CPU I
 - d. Reading the analog inputs of CPU II
 - e. Reading the digital inputs of CPU I
 - f. Reading the digital inputs of CPU II
 - g. Writing the analog outputs of CPU I
 - h. Writing the analog outputs of CPU II
 - i. Writing the digital outputs of CPU I
 - j. Writing the digital outputs of CPU II
 - k. Writing/ Reading the digital output of CPU I
13. Setup Menu
 - a. Overview
 - b. Main menu
14. Miscellaneous
15. Circuit diagram and circuit description

- a. Block diagram
- b. Ac diagram
- c. Block diagram of voltage supply,
- d. Block diagram of screen
- e. Connection layout diagram
- f. P.C.B. LP 450 level detector control (LD)
- g. P.C.B. LP 493 BLD
- h. P.C.B. LP 624 Control board
- i. P.C.B. LP 630 Mother board
- j. P.C.B. LP 631 CPU 1
- k. P.C.B. LP 632 CPU 2
- l. P.C.B. LP 633 Input board
- m. P.C.B. LP 634 output board
- n. P.C.B. LP 635 Display board
- o. P.C.B. LP 636 external connectors
- p. P.C.B. LP 638 Power supply
- q. P.C.B. LP 639 Power logic
- r. P.C.B. LP 643.3 Control board (Hep)
- s. P.C.B. LP 644.3 Display board (Hep)
- t. P.C.B. LP 645 position sensor membrane pump
- u. P.C.B. LP 647 Power logic A
- v. P.C.B. LP 649 Display board
- w. P.C.B. LP 742 Interference filter
- x. P.C.B. LP 743 power control 2
- y. P.C.B. LP 744 Power control 1
- z. P.C.B. LP 747 Distribution board
- aa. P.C.B. LP 748 Display board (BP)
- bb. P.C.B. LP 758 COMMCO – II
- cc. P.C.B. LP 763 Multi interface board
- dd. P.C.B. LP 922 Display board
- ee. P.C.B. LP 923 Traffic light
- ff. P.C.B. LP 924 Display board

Biostatistics

1. Statistics: What is statistics – Importance of statistics in behavioural sciences – Descriptive statistics and inferential statistics – Usefulness of quantification in behavioural sciences
2. Measurements – Scales of measurements – Nominal, Ordinal, Interval and Ratio scales. Data collection – Classification of data – Class intervals – Continuous and discrete measurements – Drawing frequency polygon – types of frequency polygon – Histogram – Cumulative frequency curve – Ogives – Drawing inference from graph.
3. Measures of central tendency – Need – types: Mean, Median, Mode – Working out these measures with illustrations.
4. Measures of variability – Need – Types: Range, Quartile deviation, Average deviation, Standard deviation, Variance – Interpretation.
5. Normal distribution – General properties of normal distribution – Theory of probability – illustration of normal distribution – area under the normal probability curve.
6. Variants from the normal distribution – skewness – Quantitative measurement of skewness – kurtosis – measurement of kurtosis – factors contributing for non-normal distribution.
7. Correlation – historical contribution – meaning of correlation – types:-Rank correlation, Regression analysis.
8. Tests of significance- need for – significance of the mean – sampling error- significance of differences between means – interpretation of probability levels – small samples – large

Residency part –II

In the residency the professional is expected to work and contribute in the dialysis therapy technology unit.

Third Semester

Nephrology & Kidney disease

1. Patient Assessment
 - a. Physical Diagnosis
 - b. Urinalysis
 - c. Measurement of Glomerular Filtration Rate
 - d. Measurement of Urinary Protein
 - e. Renal Imaging Techniques
 - f. Renal Biopsy
 - g. Indications for Dialysis
 - h. Drug Therapy in Renal Disease
2. Clinical Syndromes
 - a. Etiology, Pathophysiology, and Diagnosis of Acute Renal Failure
 - b. Management of Acute Renal Failure
 - c. Prerenal Azotemia
 - d. Obstructive Uropathy
 - e. Asymptomatic Proteinuria
 - f. Asymptomatic Hematuria
 - g. Acute Glomerulonephritis
 - h. Rapidly progressive Glomerulonephritis
 - i. Nephrotic Syndrome
 - j. Nephrolithiasis
 - k. Urinary Tract Infection
 - l. Disorders of Tubular Function
3. Primary Glomerular Disease
 - a. Minimal Change Disease
 - b. Focal Segmental Glomerulosclerosis
 - c. Membranous glomerulopathy
 - d. IgA Nephropathy
 - e. Membranoproliferative Glomerulonephritis
4. Secondary Glomerulonephritis
 - a. Diabetic Nephropathy
 - b. Lupus nephritis
 - c. Post infectious glomerulonephritis
 - d. Hepatitis-Associated Glomerulonephritis
 - e. HIV-Associated Renal Disorders
5. Other parenchymal Renal Diseases
 - a. Renal Dysplasia
 - b. Cystic Diseases of the Kidneys
 - c. Other hereditary Renal diseases
 - d. Reflux Nephropathy
 - e. Renal Vasculitis
 - f. Other Vascular Renal Disorders

- g. Sickle Cell Nephropathy
- h. Renal Disease due to dysproteinemias
- 6. End-Stage Renal Diseases Causes and Consequences
 - a. Epidemiology and outcomes of End-Stage Renal Disease
 - b. Renal Osteodystrophy
 - c. Uremic pericarditis
 - d. Anemia Associated with Renal Failure
 - e. Other manifestations of Uremia
- 7. End-Stage Renal Disease Management
 - a. Technical Aspects of Hemodialysis
 - b. Hemodialysis: Assessing Adequacy
 - c. Complications of Hemodialysis
 - d. Technical Aspects of Peritoneal Dialysis
 - e. Complications of Peritoneal Dialysis
 - f. Renal Transplantation: Epidemiology and outcomes
 - g. Renal Transplantation: Donor and Recipient Evaluation
 - h. Renal Transplantation: Classification and consequences of Rejection
 - i. Renal Transplantation: Immunosuppression
 - j. Complications of Renal Transplantation
- 8. Hypertension
 - a. Essential Hypertension
 - b. Renal parenchymal hypertension
 - c. Renovascular Hypertension
 - d. Pheochromocytoma
 - e. Other Causes of Secondary Hypertension
 - f. Hypertensive Emergencies
 - g. Childhood Hypertension
- 9. Acid-Base and Electrolyte Disorders
 - a. Metabolic Acidosis
 - b. Metabolic Alkalosis
 - c. Respiratory Acidosis
 - d. Respiratory Alkalosis
 - e. Hyponatremia and Hypernatremia
 - f. Hypokalemia and Hyperkalemia
 - g. Hypocalcemia and Hypercalcemia
 - h. Phosphorus
 - i. Magnesium

Emergency medicine/ACLS/Renal Nutrition

A. BLS

1. BLS in perspective
 - a. The need for Medical interventions
 - b. The ultimate Coronary Care Unit
 - c. Emergency Cardiac Care
 - d. The chain of Survival
 - e. Role of the American Heart Association
2. Cardio Pulmonary Function and actions for survival
 - a. The Cardiovascular and Respiratory system
 - b. Action for survival
3. Risk factors and prudent Heart living

- a. Risk factors for Heart Attack
 - b. Prudent Heart Living
 - c. Summary: The role of Prevention
4. Adult BLS
- a. Citizen response to Cardio-pulmonary Emergency
 - b. Indication for BLS
 - c. The sequence of BLS; Assessment, EMS activations and the ABC of CPR
 - d. CPR performed by one rescuer and two rescuers
 - e. Foreign – Body airway obstruction Management
 - f. CPR: The Human Dimension
 - g. BLS Research Initiative
5. Special Resuscitation Situation
- a. Stroke
 - b. Hypothermia
 - c. Near – Drowning
 - d. Cardiac arrest associated with Trauma
 - e. Electric shock and lightning stroke
 - f. Pregnancy
 - g. Asphyxiation
 - h. Special techniques and pitfalls and complication
 - i. Unique situation
6. Pediatric BLS
- a. Epidemiology
 - b. Injury prevention
 - c. Prehospital care
 - d. The sequence of Pediatric BLS - the ABC of CPR
 - e. Activation of the EMS system obstructive
 - f. Foreign Body airway
 - g. BLS in Trauma
7. Ethical and Legal considerations
- a. Values in Decision Making
 - b. Instituting and Discontinuing CPR
 - c. Legal mandates
 - d. Conclusions
 - 8. Safety during CPR Training and actual rescue
 - a. Disease transmission during CPR Training
 - b. Disease transmission during actual performance of CPR
 - 9. Automated External Defibrillation
 - a. Importance of Automated External Defibrillation
 - b. Overview of Automated External Defibrillation
 - c. Advantage and Disadvantage of Automated External Defibrillation
 - d. Use of Automated External Defibrillation during Resuscitation attempts
 - e. Automated External Defibrillation treatment algorithm
 - f. Post resuscitation care
 - g. Training
 - h. Maintenance of Skills
 - i. Medical control
 - j. Quality assurance

B. ACLS

1. Cardiopulmonary Resuscitation and Advanced Cardiac Life Support
 - a. Basic Life Support
 - b. 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.
 - c. Specific Arrest Sequences in Advanced Cardiac Life Support : VF and Pulseless VT – Systole-Bradycardia-Pulseless electrical activity(PEA)-Tachycardias
 - d. Post resuscitation Management
 - e. Common Medications Used in Advanced Cardiac Life Support : Epinephrine-Atropine sulfate-Lidocaine-Procaïnamide hydrochloride-Bretylium tosylate-magnesium sulfate-adenosine-Diltiazem or verapamil-Isoproterenol-Sodium bicarbonate-Calcium
2. Critical Care
 - a. Respiratory Failure: General considerations-pathophysiology-Blood gas analysis
 - b. Oxygen therapy: Nasal prongs-venturi masks-Nonrebreathing masks-A continuous positive airway pressure mask-Bilevel positive airway pressure
 - c. Airway Management and Tracheal Intubation: Airway Management-Endotracheal intubation-Surgical airways
 - d. 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
 - e. Shock: Resuscitative Principles-Individual shock states
 - f. Hemodynamic Monitoring and Pulmonary Artery Catheterization: Indications-obtaining a pulmonary capillary wedge tracing-acceptance of PAOP readings-transmural pressure-Cardiac output-Interpretation of hemodynamic readings
3. Cardiac Arrhythmias
 - a. Recognition and Management: Clinical diagnosis of arrhythmias-Electrocardiographic data-Bradyarrhythmias-premature complexes-Tachycardia-
 - b. Antiarrhythmic Drug Therapy: General Principles-Antiarrhythmic agents
 - c. Related Topics: Syncope-Electro-cardioversion-Cardiac pacing-Anti-tachycardia devices

C. Renal Nutrition

Part I: Nutrition

1. Energy (Calories)
2. Protein
3. Lipid (Fats& Cholesterol)
4. Carbohydrates
5. Thiamine vitamin B1, aneurine
6. Riboflavin
7. Vitamin B6 (pyridoxine, adermin)
8. Nicotinic acid (Niacin, nicotinamide)
9. Folic acid (folate, folacin, pteroylglutamic acid)
10. Vitamin b12 (cobalamin)
11. Pantothenic acid(filtrate factor)
12. Choline, biotin
13. Ascorbic acid (vitamin C)
14. Vitamin A
15. Vitamin D

16. Vitamin E
17. Vitamin K
18. Bioflavonoid (vitamin P)
19. Sodium
20. Potassium
21. Iron
22. Calcium
23. Phosphate
24. Magnesium
25. Manganese
26. Iodine
27. Copper
28. Cobalt
29. Chloride
30. Fluoride
31. trace elements
32. Dietary Fibers
33. Water

Part II: Foods

1. Wheat
2. Rice
3. Pulses
4. Soya beans
5. Maize
6. Millets
7. Milk
8. Egg
9. Meats
10. Nuts & Dried Fruits
11. Sweet foods & sweetening agents
12. Fish
13. Vegetables
14. Fruits
15. Spices
16. Beverage
17. Alcohol

Part III: Clinical Dietetics

1. Diet Prescription
2. Peptic ulcer
3. Flatulence
4. Constipation
5. Diarrhea& dysentery
6. Malabsorption syndrome
7. Inflammatory bowel disease
8. Liver disease
9. Jaundice
10. Hepatic Coma
11. Cirrhosis of liver
12. Fatty liver
13. Protein- Energy malnutrition
14. Gallstone Diseases

15. Anemic
16. Under weight
17. Obesity
18. Diabetes mellitus
19. Gout
20. Kidney disease
21. Renal failure
22. Kidney stones
23. Coronary Heart Diseases and atherosclerosis
24. High BP
25. Congestive cardiac failure
26. Acid and alkaline foods
27. Tube feeding
28. Parenteral nutrition
29. Pregnancy and lactation
30. Diet for children
31. Diet in old age
32. Diet for athletes

Part IV: Principles of Nutritional Assessment

1. Introduction
 - a. Nutritional assessment system
 - b. Methods used in nutritional assessment
 - c. The design of nutritional assessment system
 - d. Evaluation of nutritional assessment indices
 - Reference distribution
 - Reference limits
 - Cutoff points
2. Food consumption of Individual
 - a. Methods
 - b. New development in measuring food consumption
 - c. Selecting an appropriate method
 - d. Summary
3. Evaluation of nutrient intake data
 - a. Tables of recommended nutrient intakes
 - b. Evaluating Nutrient intakes of individuals
 - c. Evaluating the nutrient intakes of population groups
 - d. Probability approach to evaluating nutrient intakes
4. Anthropometric assessment
 - a. Advantages and limitations of anthropometric assessment
 - b. Sources of error in nutritional anthropometry
 - c. Evaluation of anthropometric indices
5. Anthropometric assessment of growth
 - a. Growth measurement
 - b. Indices derived from growth measurements
6. Anthropometric assessment of body composition
 - a. Assessment of body fat
 - b. Assessment of fat-free mass
7. Laboratory assessment of body composition
 - a. Chemical analysis of cadavers
 - b. Total body potassium using ^{40}K
 - c. Total body water using isotope dilution

- d. Other body fluid compartments using isotope dilution
 - e. Total body nitrogen
 - f. Densitometry
 - g. Other laboratory method for determining body composition
8. Laboratory Assessment
 - a. Static biochemical tests
 - b. Functional tests
 - c. Selection of laboratory tests
 - d. Evaluation of laboratory indices
 9. Assessment of protein status:
 - a. Assessment of somatic protein status
 - b. Assessment of visceral protein status
 - c. Metabolic changes as indices of protein status
 - d. Muscle function tests
 - e. Immunological tests
 10. Assessment of iron status
 - a. Hemoglobin
 - b. Hematocrit
 - c. Red cell indices
 - d. Serum iron, TIBC and transferrin saturation
 - e. Serum ferritin
 - f. Erythrocyte protoporphyrin
 - g. Multiparameter indices
 11. Assessment of status of thiamin, riboflavin and niacin
 - a. Assessment of thiamin status
 - b. Assessment of riboflavin status
 - c. Assessment of niacin status
 12. Assessment of the status of folate and vitamin B12
 - a. Assessment of folate status
 - b. Assessment of vitamin B12 status
 13. Assessment of the status of calcium, phosphorus and magnesium
 - a. Assessment of calcium status
 - b. Assessment of phosphorus status
 - c. Assessment of magnesium status
 14. Clinical assessment
 - a. Medical history
 - b. Physical examination
 15. Nutritional assessment of hospital patients
 - a. Methods based on single indices
 - b. Prognostic nutritional indices
 - c. Hospital prognostic indices
 - d. Cluster analysis
 - e. Subjective global assessment the prognostic value of nutritional assessment indices

Nephro-Radiological and imaging sciences

1. Evaluation of renal function and diagnostic tests - Evaluation of GFR & renal plasma flow – glomerular filtration rate – methodology of estimating clearance of solutes – endogenous creatinine clearance – radionuclide clearance – plasma disappearance methodology – GFR by non-radioactive clearance markers – renal blood flow and renal plasma flow.
2. Ultrasound: Elementary ultrasound methodology – sonographic imaging characteristics – Doppler ultrasound – scanning techniques – ultrasound of the normal kidney – acute renal

- failure – surgical – medical renal disease – renal masses – cysts- solid renal masses – calculi – intrarenal hematomas – renal transplant evaluation – rejection – renal infections – ultrasound versus intravenous contrast studies – percutaneous vs. guided ultrasonics – Doppler ultrasound in evaluation of renal vascular disease – evaluation of anatomic abnormalities.
3. Radionuclide Renography: Methodology – selection of radionuclide – the gamma camera – indications – limitations – quantifications of renal function – GFR – effective renal plasma flow – obstructive uropathy – vesicoureteral reflux – renal transplantation – acute renal failure – Reno vascular HT – captopril renography – static renal imaging.
 4. Computed Tomography Of The Kidney: Anatomy – technique – renal masses – cystic masses – solid renal masses – tumors of the renal pelvis – renal calculi – obstructive uropathy – infarction – acute renal cortical necrosis – renal vein thrombosis – renal artery stenosis – acute pyelonephritis – renal and perinephric abscess – emphysematous pyelonephritis – pyelonephrosis – xanthogranulomatous pyelonephritis – tuberculous pyelonephritis – congenital anomalies – renal trauma – transplant kidneys
 5. Urography: Urographic contrast media – choice – structure – contrast selection – contrast reaction – rate of administered contrast material – methodology of intravenous urography – indications – contra indications – interpretation.
 6. Magnetic Resonance Imaging: technical aspects – magnetic resonance with IV contrast – normal kidney – congenital anomalies – obstruction – injection – renal parenchymal disease – hypertension and renal vascular disease – renal cysts – benign neoplasm's – malignancies of kidney – transplantation – magnetic resonance spectroscopy.
 7. Renal Angiography: Indications – relative contraindications – patient preparation – basic procedure – specific techniques – abdominal aortography – selective renal arteriography – inferior venacava graphy – selective renal venography – renal vein rennin sampling – intraarterial – digital subtraction angiography – IV digital subtraction angiography – Complications – outpatient arteriography – Angioplasty – renal artery stunts – transcatheter embolization.
 8. Renal Biopsy: techniques of percutaneous renal biopsy – choice of needle – biopsy technique – transjugular renal biopsy – open renal biopsy – contraindication – complication – processing of the biopsy specimen – malignancy of specimen interpretation.
 9. Serologic Evaluation Of The Renal Patient: Serum complement – Differential diagnosis of glomerulonephritis – nephritic factors – ANCA – P-ANCA subtypes – C- ANCA antineutrophil cytoplasmic antibodies – ANCA – antiGBM antibody in Alport's syndrome and transplantation – antinuclear antibodies – ANA – anti double stranded DNA - antisingle stranded DNA – Ab to smith antigen and ribonucleoprotein – other antinuclear antibodies – antiphospholipid antibodies – myoglobulins- ASO titre – other serologic tests for antibodies to Group A streptococcal antigens – serologic markers of other infectious agents.
 10. Serum protein electrophoresis and immunoelectrophoresis – miscellaneous serologic tests.
 11. Evaluation Of Serum Electrolytes: Creatinine and BUN – serum electrolytes – sodium – potassium – chloride – bicarbonate – serum creatinine – urea – BUN.
 12. Urinalysis And Urine Electrolysis: Urinalysis – specimen collection – colour appearance – specific gravity – osmolality – urinalysis – proteinuria – glucose – blood pigments – microscopic examination of sediment – RBC casts – hemoglobin – renal tubular granular casts – leukocyte casts – automated urinalysis – measurement of urine electrolytes – experimental urine tests – measurement of LMW proteins – immunologic assays for specific renal antigens.

Residency part – III

In the residency the professional is expected to work and contribute in the dialysis therapy technology unit.

Recent Advances in Dialysis & Nephrology

1. Pediatric Dialysis

- a. Pediatric HD - Introduction, HD in ARF causes of ARF in children, Indication for Dialysis, principles of Dialysis in ARF, HD in acute poisonings, HD for inborn errors of metabolism, acute vascular assess.
 - Chronic HD- incidence and etiology of terminal renal failure in pediatric population, patient selection, facilities for treatment, indication for dialysis, technical aspects of pediatric HD , vascular access, AV fistula, bridge grafts, catheters, complication of vascular access, HD equipment.
 - Methods of Pediatric Dialysis: - Common problem associated with long term HD, preparation of a child for eventual kidney Transplantation.
- b. Pediatric PD - Peritoneal dialysis kinetics in children, catheter placement, PD in ARF, APD for reasons others than ARF, PD in CRF, Intermittent PD, Continuous PD, CAPD, CCPD, PD in small infants, complication of PD, supplemental therapy, the future of PD in children, transplantation of patients on PD.
- c. Nutritional Management of Pediatric patients on chronic Dialysis: Introduction, Nutritional Assessment, Anthropometrics parameters, Biochemical assessment, Radiological assessment, Dietary recommendations, Energy requirements, protein require, Lipid require, sodium, Potassium, water, renal osteodystrophy, Vitamin D therapy, vitamins, Trace elements: Iron, Zinc and Copper, Nutritional considerations for the infant receiving CAPD or CCPD treatment.
- d. Psychosocial problems related to dialysis in pediatric patients: Introduction, Adjustment, compliance, neuropsychological development, and rehabilitation.
- e. Pediatric CAV Hemofiltration: Pediatric operational principles of CAVH, characteristics of available hemofilters, practical operational details, clinical experience in the neonate, clinical experience in older children, conclusion.
- f. Transplantation in infancy:- Introduction, indications for renal replacement therapy in infancy, renal failure in infancy, growth in infants with renal failure, neurologic development in infants with renal failure, dialysis in infants, PD in infancy, complication of PD in infancy, immunologic effects of PD in the infant hemodialysis in infancy, Renal transplantation in infancy, preparation for infant transplant, post transplantation complication, immunosuppression protocols, identification and treatment of allograft rejection, growth post-transplant in the infant, cost and (RE) hospitalization in the infant with ESRD, Summary.
- g. Management of common Electrolyte Disorders in children.
- h. Clinical Care Coordinator: The Pediatric Nephrology Technologist of the Future.

2. Clinical considerations in the Evaluation of Dialysis Patients

- a. Hypertension in Dialysis Patients
- b. Left Ventricular Dysfunction in Dialysis Subjects
- c. Coronary Artery Disease in End-Stage Renal Disease
- d. Autonomic Function and hemodynamic stability in End- Stage Renal Disease Patients
- e. Infection and immunity in End-stage Renal Disease
- f. B2-Microglobulin- Associated Amyloidosis of End-Stage Renal Disease
- g. Renal Osteodystrophy
- h. Dyslipidemias of End-Stage Renal Disease
- i. Selection of Therapy for Patients with End-stage Renal Disease
- j. Malnutrition and Intradialytic Parenteral Nutrition in ESRD Subjects

- k. Disorders of Hemostasis in Dialysis Patients
 - l. Treatment of Anemia in Dialysis Subjects
 - m. Acquired Cystic Kidney Disease
 - n. Geriatric Dialysis Patients
 - o. Diabetic Dialysis Patients
 - p. Hemodialysis and Hemoperfusion for poisoning
 - q. Dialysis considerations in the patient with Acute Renal Failure
 - r. Infections in patients on Continuous Ambulatory Peritoneal Dialysis
 - s. Balancing outcomes in Dialysis with Economic Realities
3. Recent Advance in Dialysis and Nephrology
 4. Cyber Nephrology

Renal transplantation and coordination/Psychology

A. Renal transplantation and coordination

1. History of Transplantation
2. Characteristics of the allogenic immune response
3. Tolerance and immunity:
 - a. Self – Non-self-discrimination
 - b. Antigen recognition
 - c. Immune tolerance
4. Transplantation antigens :
 - a. ABO, Monocyte and Endothelial cells Ag
 - b. Major + Minor Histocompatibility Ag
5. Major Histocompatibility Complex
 - a. HLA GI and HLA GII
 - b. Nature of Allorecognition
 - c. Inheritance of HLA.
6. Tissue typing :
 - a. HLA typing, Short term vs long term/ quality of typing
 - b. Matching for split Ags, relative strengths of HLS cocci
 - c. Effects of blood transfusion
7. Regulation of the Immune response –
 - a. Role of Ag prescribing cell.
 - b. T Cell receptor recognition of Ag
 - c. CD4/CD8 cells subsets
 - d. Accessory molecules
 - e. T Cell activation
 - f. T Cell energy
 - g. Lymphokines and lymphokine receptors
 - h. Th1 + Th2 cell subsets
8. Graft rejection
 - a. Hyperacute / acute/ accelerated/chronic
 - b. Mechanisms – Ab mediated/T cell mediated/ Delayed Type/ hypersensitivity – mediated NK cell mediated.
9. Mechanisms of Immunosuppression – Corticosteroids/ Azathioprine/FK506/ Rapamycin/Polyclonal immuno Globulins/MAB
10. Donor specific immune tolerance/ Tolerance induction by blockade of co stimulation
11. Evaluation of the donor + recipient – special issued + consideration prior kidney Transplantation /Age/Diabetes mellitus/Cardiovascular disease/ infections/Malignant neoplasms / metabolic bone disease GI disease/ pulmonary/ urologic evaluation/ systemic disease /psychiatric problems/ vascular disease.

12. Immunological evaluation of the Transplant recipient – typing + Ag matching
13. Screening of Humoral sensitization
14. Cross matching – techniques
15. ABO Blood group matching/ family testing to determine haplotypes/ Cellular assays for HLA testing/ Analysis of survival data.
16. Kidney donation – live donation – non related / related donors, cadaver.
 - a. Cadaver organ harvesting and preservation
 - b. Kidney preservation – solutions
17. Transplant surgery + potential complications – Pre-OP care/Surgical technique, post OP management/ potential complications.
18. Immunosuppressive therapy – Induction protocols/ maintenance protocols.
 - a. AZA/ Steroids/ CSA – Pharmacology – drug interactions
19. Antirejection therapy – Pulse corticosteroids / ALS / OKT3
20. Clinical Approach to Allograft dysfunction – ATN/ CSA/hyperacute rejection
 - a. Ace or Acute rejection / other causes of DGF/ late chronic dysfunction.
21. Pathological diagnosis of Allograft dysfunction
22. Recurrent Glomerulonephritis
23. Denovo injury
24. Medical complications – Infections disease – Time table – viral infections – CMV/EBV
 - a. Bacterial Infection– UTI – Opp. Bact. Infections/ Fungal Infection
 - b. Cardiovascular disease – HT
 - c. Lipid disorders
 - d. Liver disease – HBV/HCV
 - e. Malignancy
 - f. M,
 - g. Diabetes Mellitus, haematological problems
25. Pancreatic – Kidney transplantation
26. Pediatric transplantation – problems.

B. Nephropsychology

1. Psychiatric Assessment
 - a. Introduction to clinical assessment
 - b. The Psychiatric interview
 - c. The mental status Exam
 - d. Physical Exam and laboratory evaluation
 - e. Intelligence testing and neuropsychological assessment
 - f. Personality assessment
2. Psychiatric Aspects of Renal Care
 - a. Introduction
 - b. Psychiatric problems: uncooperativeness-cause of uncooperativeness
 - c. Depression and Suicide, anxiety, rehabilitation problems, sexual problems
 - d. Psychiatric fitness for Transplantation
 - e. Treatment of psychiatric problems- preventive therapy-group therapies-environmental Manipulations-psychotherapy-pharmacotherapy-behavioral sexual techniques
3. Rehabilitation and Psychosocial Issues
 - a. Endurance Exercise training in hemodialysis patients
 - b. Psychosocial rehabilitation of Adult dialysis patients
 - c. Ethical Dilemmas in Dialysis: To initiate or withdraw Therapy
4. Mental Disorders
 - a. Diagnosis and classification in psychiatry

- b. Psychiatry history and examination
- c. Organic(Including Symptomatic) mental disorders
- d. Psychoactive substance use disorders
- e. Schizophrenia
- f. Mood Disorders, Anxiety and personality
- g. Other psychotic Disorders
- h. Neurotic, stress-related and somatoform disorders
- i. Disorders of Adult personality and behavior
- j. Sexual disorders
- k. Sleep disorders
- l. Behavioral syndromes associated with psychological disturbances and physiological factors
- m. Mental retardation
- n. Child psychiatry
- o. Psychopharmacology
- p. Biological methods of treatment
- q. Psychoanalysis
- r. Psycho treatment
- s. Emergency psychiatry
- t. Legal and ethical issues in psychiatry
- u. Common psychiatry

Residency part – IV- Project / Thesis/ Dissertation

Each candidate will have to carry out of a dissertation on the related subject. The dissertation will be guided by one or two members of the faculty of the department. The dissertation will be evaluated by the External/Internal Examiners. The final dissertation duly approved by the External/Internal examiners will be submitted to the Dean’s office with the result. The dean’s office will send the dissertation to the library for record.

Skills based outcomes and monitorable indicators for Clinical Instructor/Assistant Professor/Assistant Manager

Competency statements

1. Demonstrate ability to perform peritoneal dialysis
2. Administer medication under supervision of nephrologists
3. Demonstrate ability to prepare and monitor the patient for Renal Transplantation
4. Demonstrate knowledge and skills to manage patient in ICU care and CRRT

S. No.	Learning outcomes	Knowledge/comprehension	Applications / synthesis /evaluation	Hours
1	Perform peritoneal dialysis	Knowledge and understanding of the principles of peritoneal dialysis and the different types of PD	Ability to collect PD samples and follow unit protocol, document findings correctly; train a patient or carer to perform CAPD or APD and an exit site dressing	300
2	Administration of medication under supervision of nephrologists	Knowledge of proper aseptic techniques to prepare and administer medication; complications of controlled drugs	Ability to undertake drug calculations for all administration routes; administer permitted drugs as per hospital policy; take appropriate action towards complication if required under supervision	300
3	Renal Transplantation	Enable the patient to assess the risks and benefits of the organ available and facilitate obtaining their informed consent for kidney transplantation	Assess physiological and psychological functioning of the transplant recipient with monitoring and review of treatment plans in conjunction with the renal transplant team	280
4	ICU care and CRRT	Knowledge of various types of dialysis in ICU, able to competently manage a patient on CRRT	Able to troubleshoot any abnormalities and manage complications of CRRT	300
	TOTAL			1180

Chapter 5

Job description

Chapter 5: Job Description for all levels

Level 4: Diploma in Dialysis Therapy Technology

1. JOB TITLE - DIALYSIS ASSISTANT
2. JOB PURPOSE - Performing dialysis, Monitoring patients, Machine maintenance & ICU dialysis
3. ACCOUNTABILITY - Head of Department/ Chief Dialysis Therapy Technologist / Dialysis Therapy Technologist
4. QUALIFICATION - Diploma in Dialysis Therapy Technology

CLINICAL CARE RESPONSIBILITIES:

- Sets up, operates, and cleans the hemodialysis machine.
- Performing hemodialysis in dialysis unit and ICU. Connects patients to the hemodialysis machines, with aseptic precautions performs cannulation (simple arteriovenous fistula (AVF) and arteriovenous grafts (AVG)), handles AV shunts, jugular, subclavian and femoral catheters.
- Planning implementation of the dialysis prescription and execution of hemodialysis therapy.
- Documentation of patient data on charts as per unit policies.
- Managing various intra-dialytic complications, notifies shift supervisor of any unusual change in the patient's condition and performing related duties as assigned under the supervision of dialysis Technologist, physician or nephrologist.

CLINICAL OUTCOMES RESPONSIBILITIES:

- Patient education, psychosocial and diet counseling of dialysis patients.
- Maintaining and monitoring, dialysis adequacy, clinical quality practices and infection control within the dialysis unit as per unit policies.

EQUIPMENT & REUSE PRACTICE RESPONSIBILITIES:

- Supervise the proper functioning, preventive maintenance, conduct minor repairs of the dialysis machines and reverse osmosis water systems.
- Setting up and monitoring the dialysis system and machines as per unit protocols.
- Maintenance of infection control practices by regular dialysis machine and equipment disinfection as per unit protocols.
- Ensure mandatory compliance of guideline based reuse practices of dialysis disposables when applicable.

Level 5: BSc Dialysis Therapy Technology /BSc.DTT

1. JOB TITLE - DIALYSIS THERAPY TECHNOLOGIST
2. JOB PURPOSE - Performing dialysis, monitoring patients, machine maintenance, ICU dialysis
3. ACCOUNTABLE TO - HOD/ Chief Dialysis Therapy Technologist
4. QUALIFICATION - B.Sc. Dialysis Therapy Technologist (3 years+ one-year internship)

CLINICAL CARE RESPONSIBILITIES:

- Planning implementation of the dialysis prescription, execution of regular hemodialysis therapy.
- Assumes the role of a shift supervisor and assists with the supervision of hemodialysis assistants and auxiliary personnel. Assists the hemodialysis assistant in the use of new or modified techniques, dialysis equipment.

- Performing unusual, difficult and complex dialysis modalities such as slow continuous therapies (CRRT), SLED (slow low efficiency dialysis), Hemoperfusion, Plasmapheresis, Isolated ultrafiltration, peritoneal dialysis, and MARS in the dialysis and ICU.
- Managing under the supervision various intra-dialytic complications or referring to the dialysis physician or nephrologist.
- Documents and maintains dialysis patient records (e.g. patient daily log, treatment records and charts, dialysis machine maintenance, service records, laboratory equipment and-blood chemistry data, and other auxiliary dialysis equipment, water treatment maintenance records etc.).
- Assists in the training of care givers/family members of outpatients in the operation of the hemodialysis machines to facilitate home hemodialysis or peritoneal dialysis.
- Performing both acute, and chronic peritoneal dialysis. Aiding patient selecting for CAPD, CCPD and NIPD based on their convenience and economic status. Educating and training patients on peritoneal dialysis procedures and sterile techniques. Maintaining data and records for analysis and improve patient outcomes. Counseling PD patients on psychosocial needs, educating on nutritional needs in coordination with dietitians and transplant needs in consultation with nephrologist.
- Preparation of daily and weekly reports.
- Maintaining data and records for analysis and improve patient outcomes. Under supervision of the treating nephrologist is responsible to coordinate the care of potential renal transplant patients and donor by facilitating testing, maintaining documents and communicating with transplant coordinators, surgical or anesthesia teams under nephrologist supervision.

CLINICAL OUTCOMES RESPONSIBILITIES:

- Patient education, psychosocial and diet counseling of dialysis patients.
- Maintaining and monitoring, dialysis adequacy, clinical quality practices and infection control within the dialysis unit as per unit policies.

EQUIPMENT & REUSE PRACTICE RESPONSIBILITIES:

- Supervise the proper functioning, preventive maintenance, conduct minor repairs of the dialysis machines and reverse osmosis water systems.
- Setting up and monitoring the dialysis system and machines as per unit protocols.
- Maintenance of infection control practices by regular dialysis machine and equipment disinfection as per unit protocols.
- Ensure mandatory compliance of guideline based reuse practices of dialysis disposables when applicable.

Level 6-8: M.Sc. Dialysis Therapy Technology /MSc.DTT

1. JOB TITLE - Assistant Professor
2. JOB PURPOSE - Teaching and Research in renal sciences (Dialysis Therapy Technology)
3. ACCOUNTABLE TO - Head of Department
4. QUALIFICATION - M. Sc. Renal Sciences and Dialysis Technology Technology

CLINICAL CARE RESPONSIBILITIES:

- Supervises the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts, including planning and scheduling.
- Providing expert support within the unit in the handling of all hemodialysis and peritoneal dialysis related and patient related issues, e.g. dialysis complications, dietary consultations, psychological care and vascular access issues in coordination with the nephrologists.
- Monitoring the dialysis patients for intra dialytic complications.

- Guiding and teaching the students about pediatric dialysis.
- Guiding the staff and students on dialysis unit policies, infection control and quality control standards as per unit policies.
- Quality maintenance and overall supervision of special procedures performed by the unit e.g. CRRT, ICU dialysis, pediatric dialysis, plasmapheresis, hemoperfusion, SCUF, and MARS.
- Supervising the conduct of regular ongoing patient education nutritional counseling programs in the dialysis unit.
- Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.

CLINICAL OUTCOMES RESPONSIBILITIES:

- Patient education, psychosocial and diet counseling of dialysis patients.
- Maintaining and monitoring, dialysis adequacy, clinical quality practices and infection control within the dialysis unit as per unit policies.
- Supervising data documentation, data collection, data validation and outcomes evaluation within the unit.
- Preparation of quarterly and annual reports

EQUIPMENT & REUSE PRACTICE RESPONSIBILITIES:

- Supervise the proper functioning, preventive maintenance, conduct minor repairs of the dialysis machines and reverse osmosis water systems.
- Setting up and monitoring the dialysis system and machines as per unit protocols.
- Assist in implementing new or modified techniques; recommending the purchase of new equipment or the modification of present equipment; and maintaining adequate supplies for the performance of hemodialysis on the particular shift assigned
- Maintenance of infection control practices by regular dialysis machine and equipment disinfection as per unit protocols.
- Ensure mandatory compliance of guideline based reuse practices of dialysis disposables when applicable to ensure quality clinical care.

ADMINISTRATIVE RESPONSIBILITIES:

- Evaluates the quality of hemodialysis services performed.
- Performs human resource related duties (e.g. employee evaluation, need for additional manpower, recommending promotions, compensation increases, conduct ongoing employee training and staff grievance redressals).
- Ensures that hemodialysis equipment is in proper operating condition.
- Evaluates the quality and quantity of supplies and equipment.

TEACHING RESPONSIBILITIES:

- Teaching of undergraduate (BSc & MSc dialysis) students and coordinating all academic programs, e.g. clinical and theoretical teaching, conducting assessments and examinations for the diploma, B.Sc. candidates and interns.

RESEARCH RESPONSIBILITIES:

- Encouraging, conducting and mentoring research.
- Enforcing ethical research standards

Level 9-10: PhD Dialysis Therapy Technology

1. JOB TITLE - Professor or Head of Department

2. JOB PURPOSE - Clinical Care, Teaching and Research in renal sciences , dialysis therapy technology
3. ACCOUNTABLE TO - Head of Department/ Medical Superintendent/CEO
4. QUALIFICATION - PhD, Renal Sciences and Dialysis Therapy Technology

EQUIPMENT & REUSE PRACTICES:

- Supervise the implementation of all the policies, protocols and procedures within the dialysis unit.
- Ensure proper functioning, preventive maintenance, conduct minor repairs of the dialysis machines and reverse osmosis water systems.
- Maintenance of infection control and quality control practices as per unit protocols.
- Ensure mandatory compliance of guideline based reuse practices of dialysis disposables when applicable.

CLINICAL & ADMINISTRATIVE RESPONSIBILITIES:

- Supervises the activities of all categories of hemodialysis staff and auxiliary personnel on all shifts, including planning, and scheduling as per unit policies.
- Confers with nephrologists, physicians, nurses to schedule patients, determine individual patient treatment time and establish patient triage for dialysis depending on comorbidity and severity of disease.
- Supervises the maintenance of all patient records, laboratory parameters.
- Evaluates the quality of hemodialysis services performed.
- Overall care of patient outcomes, patient satisfaction scores and patient safety issues.
- Performs human resource related duties (e.g. recommending promotions, compensation increases, conduct ongoing employee training and staff grievance redressals).
- Evaluates the quality and quantity of supplies and equipment.
- Ensures that hemodialysis equipment is in proper operating condition.
- Formulating a dialysis unit policy and procedures manual to ensure quality clinical care and quality administrative governance of the unit.
- Implements departmental policies and procedures and recommends changes as necessary. Coordinates activities of the hemodialysis unit with the other departments/facilities of the organization.
- Keep abreast of current trends in hemodialysis techniques and management to ensure ongoing organizational change and learning to improve patient care and outcomes.

TEACHING RESPONSIBILITIES:

- Teaching of undergraduate (BSc & MSc dialysis) students and coordinating all academic programs, e.g. clinical and theoretical teaching, conducting assessments and examinations for the diploma, B.Sc. & MSc candidates and interns with documentation as needed.
- Planning and implement ongoing staff educational and skills training programs with continual assessments and monitoring outcomes thereby ensuring on going organizational learning in consultation with the head of department and nephrology staff.

RESEARCH RESPONSIBILITIES:

- Encouraging, conducting and mentoring research.
- Encouraging research methodology training among the students and faculty.
- Enforcing ethical research standards.

Allied and Healthcare Professions

Allied and healthcare professionals includes individuals involved with the delivery of health or healthcare related services, with qualification and competence in therapeutic, diagnostic, curative, preventive and/or rehabilitative interventions. They work in multidisciplinary health teams in varied healthcare settings including doctors (physicians and specialist), nurses and public health officials to promote, protect, treat and/or manage a person(s) physical, mental, social, emotional, environmental health and holistic well-being.

The wide variation in the understanding of the concept of allied and healthcare professional, better known as 'paramedic', the nomenclature, and functions has led to the poor image of allied and healthcare sciences in India. The use of the word paramedic itself limits the activities of AHPs in the system. Hence, it is imperative to adequately compensate these professionals based on their qualifications and specialties. Despite a huge demand for services from this sector, allied and healthcare sciences is highly fragmented. As per the report 'From Paramedics to Allied Health Sciences', in total 138 courses of varied levels were identified during the process. Although it is estimated that there may be many more courses which are yet to be identified.

Considering the lack of regulatory mechanism following 15 core professional groups (accounting for around 44 professions) has been enlisted below **(The list is illustrative of the allied and healthcare professions. In future there may be addition or removal of certain professions based on the state of their regulation and standardization). It also needs a mention that most of these professions are not restricted to the professional groups under which they have been categorized, their role may extend to other professional services too. Similarly, the categorization is an indicative categorization, however this may evolve over time based on deeper understanding of the roles and responsibilities of each professional group:**

1. Healthcare Professions

1. Optometry
2. Physiotherapy
3. Occupational Therapy
4. Nutrition Sciences
5. Physician Associate and Assistants

2. Allied Health Professions

6. Cardiology, Vascular and Pulmonary Technology
7. Medical Laboratory Sciences
8. Medical Radiology and Imaging Technology
9. Neurosciences Technology
10. Non- direct and Administrative services
11. Primary Care and Community services
12. Radiation Therapy
13. Renal Technology
14. Surgical and Anesthesia related Technology
15. Trauma Care Services

The above mentioned groups account for over 44 job profiles in the allied and healthcare space, which are as follows-

A. Healthcare Professions

1. Optometry
 - a. Optometrist
2. Physiotherapy
 - a. Physiotherapist

3. Occupational Therapy
 - a. Occupational Therapist
4. Nutrition Sciences
 - a. Nutritionist
 - b. Dietitian
5. Physician Associate and Assistants
 - a. Physician Associates and Assistants

B. Allied Health Professions

6. Surgical and anesthesia related technology
 - a. Anesthesia Assistants and Technologist
 - b. OT Technologist
 - c. Endoscopy Technologist
7. Medical Laboratory Sciences
 - a. Cyto-Technologist
 - b. Dermatology/STD /Leprosy Lab Technologist
 - c. Forensic Technologist
 - d. Hemato-Technologist
 - e. Histopath-Technologist
 - f. Phlebotomist
 - g. Medical and Clinical Lab Technologist
8. Medical Radiology and Imaging Technology
 - a. Radiographer
 - b. Radiologic /Imaging Technologist
 - c. Diagnostic Medical Sonographer
9. Renal Technology
 - a. Urology Technologist
 - b. Dialysis Therapy Technologist
10. Radiation Therapy
 - a. Radiotherapy Technologist
 - b. Medical Dosimetrist
 - c. Nuclear Medicine Technologist
11. Trauma Care Services
 - a. Emergency Medical Technologist (paramedic)
 - b. Critical Care/ICU Technologist
12. Neurosciences Technology
 - a. EEG/END Technologist
 - b. EMG Technologist
 - c. Neuro Lab Technologist
 - d. Sleep Lab Technologist
13. Cardiology, Vascular and Pulmonary Technology
 - a. Cardiovascular Technologist
 - b. ECG Technologist
 - c. ECHO Technologist
 - d. Perfusionist
 - e. Pulmonary Function (PFT) Technologist
 - f. Respiratory Therapist
14. Non- direct and Administrative Services
 - a. Biomedical Engineers and Technologist
 - b. Medical Assistant

- c. Medical Secretaries
 - d. Medical Transcriptionist
 - e. Health Information Management Technologist
15. Primary Care and community services
- a. Blood Bank Technologist
 - b. Counselor- Integrated Behavioral Health Counselors, Palliative counselors etc.
 - c. Sanitary Health Inspectors

Other Recommendations by experts:

1. The split up between theory and practical (bachelor level) proposed is as follows and accordingly the time available during the year could be allocated:
 - a. 1st year: 30% practical and 70% Theory (8hrs/day);
 - b. 2nd year: 60% practical and 40% Theory (8hrs/day) and
 - c. 3rd year: 80% practical and 20% Theory (8hrs/day).
2. For teaching faculty 1:10 student ratio is proposed.
3. Student intake was recommended as one student for each 3-dialysis hemodialysis machines in the unit with a patient load of two shifts of dialysis per day.
4. An in-house preceptor is to be allocated for each of 5 students for supervision of clinical practical, clarifications, counseling and guidance.
5. As far as possible the theory knowledge is to be backed with practical clinical scenarios to develop the needed workforce oriented or job ready knowledge, learning and therapeutic management.
6. More emphasis is to be laid more on the practical teaching
7. The diploma candidates should be able to join a bachelor's program in the second year as a lateral entry.
8. Lateral entry is to be permitted for nurses with a B.Sc. in nursing. Such a skilled pool with also enhance the clinical care of patients due their training background and contribute to improve the clinical skills within a dialysis unit.
9. An internship of a period one year after a degree completion is a must. During internship the allocation of night duties under supervision should be mandatory.
10. Logbook is mandatory and all procedures witnessed or performed under supervision as student needs to be documented in a logbook.
11. A research project is mandatory for the degree candidates and all research projects, thesis and publications to be archived and available online for use by anybody.
12. Standardized online theory session repository is to be developed for access to all candidates across the country once registered with an institution.
13. Different job cadres for those completed B.Sc. Dialysis Therapy Technology course such as Transplant coordinator, Vascular Access Coordinator and Nephrology Physician Assistant etc.

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**DETAILS OF INVOLVED/RESPONSIBLE OFFICERS AT THE MINISTRY OF
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1. Mr Ali R.Rizvi, Joint Secretary (Human Resource)
2. Mr B. Sriramachandra Murthy, Director (Allied Health Section)
3. Mr Satish Kumar, Under Secretary (Allied Health Section)

National Initiative for Allied Health Sciences – Technical Support Unit (NIAHS – TSU)

1. Ms Kavita Narayan, *FACHE*, Director, NIAHS-TSU at MoHFW, GoI
2. Ms Shivangini Kar Dave , Project Lead Coordinator
3. Ms Natasha D'Lima, Program Coordinator
4. Ms Namita Gupta, Consultant
5. Mr Sutirtha Mazumder, Senior Research Assistant
6. Mr Ashish Arora, Senior Research Assistant (former)
7. Ms Tanu Sri Sahu, Senior Research Assistant
8. Mr Akhilendra Trivedi, Senior Research Assistant
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