

Revised Ordinance Governing Regulations and Curriculum
of
M.Sc. RENAL DIALYSIS TECHNOLOGY
COURSE - 2019



**Rajiv Gandhi University of Health Sciences,
Karnataka, Bangalore**

The Emblem



The Emblem of the Rajiv Gandhi University of Health Sciences is a symbolic expression of the confluence of both Eastern and Western Health Sciences. A central wand with entwined snakes symbolises Greek and Roman Gods of Health called Hermis and Mercury is adapted as symbol of modern medical science. The pot above depicts Amrutha Kalasham of Dhanvanthri the father of all Health Sciences. The wings above it depicts Human Soul called Hamsa (Swan) in Indian philosophy. The rising Sun at the top symbolises knowledge and enlightenment. The two twigs of leaves in western philosophy symbolises Olive branches, which is an expression of Peace, Love and Harmony. In Hindu Philosophy it depicts the Vanaspathi (also called as Oushadi) held in the hands of Dhanvanthri, which are the source of all Medicines. The lamp at the bottom depicts human energy (kundalini). The script "Devahitham Yadayahu" inside the lamp is taken from Upanishath Shanth i Manthram (Bhadram Karnebh i Shrunuyanadev...), which says "May we live the full span of our lives allotted by God in perfect health" which is the motto of the Rajiv Gandhi University of Health Sciences.



ರಾಜೀವ್ ಗಾಂಧಿ ಆರೋಗ್ಯ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕರ್ನಾಟಕ, ಬೆಂಗಳೂರು

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, KARNATAKA, BENGALURU

4th T Block, Jayanagar, Bengaluru – 560 041

Ref: ACA/DCD/AHS/M.Sc.RDT/372/2019-20

Date: 28/08/2019

NOTIFICATION

Sub: Revised Ordinance pertaining to Regulation and Curriculum of M.Sc. Renal Dialysis Technology.

Ref: 1) Minutes of BOS Allied Health Sciences held on 13/05/2019
2) Proceedings of Faculty meeting held on 15/05/2019
3) Proceedings of AC meeting held on 17/06/2019
4) Proceedings of Syndicate meeting held on 29/06/2019

In exercise of the powers vested under Section 35(2) of RGUHS Act, 1994, the Revised Ordinance pertaining to Regulation and the curriculum of M.Sc. Renal Dialysis Technology is notified herewith as per Annexure.

The above Regulation shall be applicable to the students admitted to the said course from the academic year 2019-20 onwards.

By Order,
Sd/-

REGISTRAR

To

The Principals of all affiliated Allied Health Sciences Course colleges of RGUHS, Bangalore.

Copy to :

1. The Principal Secretary to Governor, Raj Bhavan, Bangalore - 560001
2. The Principal Secretary Medical Education, Health & Family Welfare Dept., M S Building, Dr.B.R. Ambedkar Veedhi, Bangalore – 01
3. PA to Vice – Chancellor/PA to Registrar/Registrar (Eva.)/Finance Officer, Rajiv Gandhi University Health Sciences, Bangalore
4. All Officers of the University Examination Branch/ Academic Section.
5. Guard File / Office copy.

REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF M.Sc. RENAL DIALYSIS TECHNOLOGY – 2019

Introduction:

The Masters of Science in Renal Science and Dialysis Technology (MSc.RDT) is specifically aimed at those pursuing a professional career in Dialysis Technology. It is designed to provide specialized training both in basic scientific principles of modern Dialysis 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 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 Technology program is to prepare accomplished professionals in Dialysis 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 Technology)
2. M.B.B.S
3. B.D.S
4. B. Sc. Nursing

Duration of the course

Duration of the course: 2 years (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. 80% attendance in theory
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 Year

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
1	Sec A: Anatomy paper (Basic anatomy /Nephroanatomy / Embryology/ Histology / Histotechniques) Sec B: Physiology (General physiology/ Nephrophysiology /Endocrinology)	100		100
2	Biochemistry	40	25	65
3	Microbiology	40		40
4	Nephropathology/Nephro-Immunology	75	30	105
5	Pharmacology	60		60
	TOTAL	315	55	370

Subsidiary Subjects:

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
1	Nephrogenetics/Molecular biology	40	25	65

2	Research Methodology/ Biostatistics	80	-	80
TOTAL		120	25	145

Second Year

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
1	Nephrology & Kidney disease& Renal Nutrition	100	125	225
2	Nephro- Radiological and imaging sciences	50	40	90
3	Recent Advances in Dialysis & Nephrology	75	135	210
4	Renal transplantation and coordination/Psychology	50	40	90
5	Project / Thesis/ Dissertation	40	200	240
TOTAL		315	540	855

Attendance

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility.

A candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear for the University Examination either in one or more subjects.

Monitoring Progress of Studies

Work Diary/Log Book- Every candidate shall maintain a work diary and record his/her participation in the training programmes- Field work, Clinical work, Seminars, Field work records and Case records etc. (Refer section III for model check lists and log book copy). Special mention may be made of the presentations by the candidate as well as details of Field/Clinical work conducted by the candidate. The work diary shall be scrutinized and certified by the concerned faculty members.

Periodic Tests: The College shall conduct three tests each in First and Second year for Internal Assessment. The Third test shall be conducted one month prior to the annual university examination so that it also serves the purpose of preparatory examination. These tests will be considered for internal assessment.

Records: Records and marks obtained in tests will be maintained by the college and made available to the university.

Dissertation/Research project

Each candidate pursuing M.Sc. MLT Course is required to carry out work on selected research project under the guidance of a recognized post graduate teacher. The results of such a work shall be submitted in the form of dissertation/ research project.

The dissertation/ research project is aimed to train a graduate student in research methods and techniques. It includes identification of problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, interpretation of results and drawing conclusions.

Every candidate shall submit to the Registrar (Academic) of the University in the prescribed Performa, a synopsis containing particulars of proposed dissertation/ research project work within six months from the date of commencement of the course on or before the date notified by the University. The synopsis shall be sent through the proper channel.

Such synopsis will be reviewed and the University will register the dissertation/ research project topic. No change in the dissertation topic/

research project or guide shall be made without prior approval of the University.

The dissertation/ research project should be written under the following headings: Introduction

Aims or objectives of study

Review of literature

Material and methods

Results

Discussion

Conclusion

Summary

References

Tables

Annexure

The written text of dissertation/ research project shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. A declaration by the candidate for having done the work should also be included, and the guide, head of the department and head of the institution shall certify the dissertation/ research project.

Four copies of Dissertation/research project shall be submitted to the university, through proper channel, along with a soft copy (CD), 6 months before the final examination. It shall be assessed by two examiners appointed by the university, one internal and one external. No marks shall be awarded for Dissertation/research project. Acceptance of the dissertation/ research project is a pre-requisite for a candidate to be permitted to appear for final examination. If there are corrections in the dissertation / research project suggested by the examiner(s), the candidate may make such corrections and may be allowed to re-submit in time and if approved can appear for the examination.

Guide

The academic qualification and teaching experience required for recognition as Guides by the

University are:

M.D. in Biochemistry/M.Sc in Clinical Biochemistry[Medical] and three years teaching experience after the PG qualification in a recognized Institution, or Ph.D. in Medical Biochemistry /Clinical Biochemistry/Clinical Research with teaching experience of at least two years in a recognized institution, or M.Phil. in Clinical Biochemistry with five years of teaching experience after M.Phil. qualification from a recognized institution, or M.Sc. MLT with five years of teaching experience after the postgraduate qualification in a recognized Institution.

The age of guide/teacher shall not exceed 63 years. The guide student ratio shall be 1:5.

Relaxation criteria: In view of acute shortage of teachers in this new specialty, those having three years full time teaching experience, after post graduation, may be considered as PG teachers. They may be permitted to be guides and examiners for the next three-years from the time of this notification. Similarly, persons aged more than 63 years may be considered as eligible to guide at the discretion of the University for at least three more years from the time of this notification.

Eligibility for guide for each speciality

Full time faculty involved in teaching in the same college/institution MD - in respective subjects -8yrs experience after MD.

M.Sc. - in respective subjects (only Medical Microbiology/Medical biochemistry degrees acceptable with minimum 8 yrs experience

Student : Guide ratio - 5:1.

Schedule of examination

University Examination will be held in two parts - Part I and Part II, at the end of I year and at the end of II year respectively. Candidates will not be allowed to take the Part II examination unless he/she has passed all papers of the Part I examination. The prescribed examination fee as laid down by the University from time to time for each entry to Part I and Part II examinations shall be paid.

The University examination will be conducted at the end of each year on a date notified by the university from time to time. Not more than two examinations shall be conducted in an academic year.

Failed candidates may appear in the subsequent examination after paying the required fee.

Carry over: A candidate who has appeared in all the subjects of I year in the university examination is eligible to go to 2nd year provided he/she has passed in any two subjects. However the candidate has to pass in the failed subjects to become eligible to appear for 2nd year university examination.

A failed candidate in any subject has to appear for both theory and practical examination in the subsequent examination.

A candidate is permitted not more than four attempts (actual appearance) to clear the first year or pass the first year examination within three academic years, from the year of admission, whichever is earlier. A candidate will not be allowed to continue the course if he/she fails to comply with the above stipulation.

The number of examiners for clinical and viva-voce shall be two, comprising of one internal and one external examiner.

Scheme of examination

Internal Assessment

Internal Assessment marks shall be awarded to the candidates in each paper as detailed in the scheme of examination.. The marks secured by the candidates in each subject shall be forwarded to the University 15 days before the University Examinations.

The marks of the internal assessment must be published on the notice board of the respective colleges.

If a candidate is absent from the test due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

There shall be minimum of two internal assessment examination in 1st year & subject of specialty in 2nd year conducted by the colleges at regular intervals both in theory & practical which includes seminars. The average of best two examination Marks shall be taken into consideration by calculating marks for the internal assessment.

University examination

The University conducts two examinations in a year at an interval not less than four to six months.

i. First year

Written examination :- Written examination shall consist of three theory papers each of three hours duration. Each paper shall carry 100 marks.

Practical examination :-

There shall be one practical examination in each of first year subject. The duration of each practical examination is of three hours which carries 100 marks.

Viva-voce :- This shall aim at assessing depth of knowledge, logical reasoning, confidence & oral communication skills. Total marks shall be 30. Both internal & external examiners shall

conduct the viva-voce.

The particulars of subjects for examination and distribution of marks are shown in the Table -III

First Year

Sl. No.	Course Titles	Hours		
		Theory	Practical	Total
1	Sec A: Anatomy paper (Basic anatomy /Nephroanatomy / Embryology/ Histology / Histotechniques) Sec B: Physiology (General physiology/ Nephrophysiology)	100		100

	/Endocrinology)			
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3	Recent Advances in Dialysis & Nephrology	75	135	210
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5	Project / Thesis/ Dissertation	40	200	240
	TOTAL	315	540	855

First Year

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 bloodflow
 - 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.

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, Yersinca & Francisella
14. Hemophilus
15. Bordelella
16. Spirochaetes
17. Miscellaneous bacteria
18. Rickettsiae
19. Chlamidiae
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

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 immunoglobulin
 - 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 plasmakinins
 - 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 chloramphenicol (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

Subsidiary Subjects:

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 chemo-luminescence.
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 accidents 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

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.

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 samples - Inferential statistics – Parametric & Non parametric methods – Elements of multivariate analysis

Second Year

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

A. 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 antisytemic vasulitis – 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 Electrolytis: Creatinine and BUN – serum electrolytes – sodium – potassium – chloride – bicarbonate – serum creatitine – 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.

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 HLA Ags
 - c. Effects of blood transfusion
7. Regulation of the Immune response –
 - a. Role of Ag presenting 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 issues + 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

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