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

1. 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. It is designed as a higher degree course suitable for graduates having experience in dialysis technology.

2. Eligibility for admission:

The students who have passed following Course from Institutions affiliated to RGUHS are eligible for this course

a. B. Sc. Dialysis Technology or equivalent as recognised by Rajiv Gandhi University of Health Sciences

b. Candidates with B. Sc. in Physics or Chemistry or Biology or equivalent as recognised by Rajiv Gandhi University of Health Sciences along with a diploma in Dialysis Technology and Minimum 2 years of working experience.

c. M.B.B.S/ BDS/ BSc Nursing as recognised by Rajiv Gandhi University of Health Sciences.

3. Eligibility certificate:

No candidate shall be admitted for the postgraduate degree course unless the candidate has obtained and produced the eligibility certificate issued by the University. The candidate has to make the application to the University with the following documents along with the prescribed fee.

- Pass/degree certificate issued by the University
- Marks cards of all the university examinations passed
- Migration certificate
- Certificate of conduct
- Proof of SC/ST or Category I

Candidates should obtain the eligibility certificate before the last date for admission as notified by the University.

A candidate admitted to the postgraduate course should register his/her name in the University within a month of admission after paying the registration fee.

4. Title of the course

Master of Science in Renal Dialysis Technology (MSc Renal Dialysis Technology)

5. Duration of the course

The duration of the Master's Degree in Renal Dialysis Technology, including submission of project work on the topic registered, shall be for two years from the commencement of the academic term on a full-time basis.

6. Medium of instruction:

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

7. Attendance:

Every candidate should attend 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 the percentage of attendance for eligibility.

A candidate lacking in the 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.

8. 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

9. Subject and hours of teaching for Theory and Practical

The number of hours of teaching theory and practical, subject wise in the First Year and Second Year are shown in Table-I, Table-II, Table-III and Table IV.

Table – I: Distribution of teaching hours in 1st year M.Sc RDT

Sl No	Main Subjects	Theory: no of hours	Practical no of hours	Total
1	Renal Anatomy and physiology	70	100	170
2	Pharmacology in Renal Diseases	70	100	170
3	Basics in Renal Replacement therapies	70	750	820
4	Imaging in Kidney Disease	70	100	170
5	Biostatistics and Research Methodology	70	100	170
	Total	**350**	**1150**	**1500**

Table – II Distribution of teaching hours in 1st year M.Sc RDT -Subsidiary subjects**

Sl No	Subsidiary Subjects	Theory: no of hours	Practical: no of hours	Total
1	Nutrition	40		40
	Total	**40**		**40**

*Main Subjects shall have University Examination.

**Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

Table - III Distribution of teaching hours in 2nd year M.Sc RDT

Sl No	Main Subjects	Theory no of hours	Practical no of hours	Total
1	Clinical Nephrology	70	100	170
2	Biomedical instrumentation and Dialysis equipment	70	200	270
3	Advancements in Extracorporeal Therapies	70	750	820
4.	Renal transplantation- Basic concept	70	100	170
5	**Project / Thesis/ Dissertation**			
	Total	**280**	**1150**	**1430**

Table - IV Distribution of teaching hours in 2nd year M.Sc RDT -Subsidiary subjects **

*Main Subjects shall have University Examination.

Sl No	Subsidiary Subjects	Theory no of hours	Practical no of hours	Total
1	Emergency medicine / ACLS	40	100	140
2	Hospital management & in a Quality healthcare	40	100	140
	Total	**80**	**200**	**280**

**Subsidiary subjects: Respective colleges shall conduct examination for subsidiary subjects.

10. Monitoring Progress of Studies

Work Diary/Log Book- Every candidate shall maintain a work diary and record his/her participation in the training programmes- Clinical work, Seminars, and Case records. 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 before the annual university examination so that it also serves the purpose of the 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.

11. Dissertation/Research project.

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

The dissertation/ research project is aimed to train a graduate student in research methods and techniques. It includes identification of the 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

- Introduction
- Aims or objectives of the study
- Review of literature
- Material and methods
- Results
- Discussion
- Conclusion
- Summary
- References
- Tables
- Annexure

The written text of the dissertation/ research project shall not be less than 50 pages and shall not exceed 100 pages, excluding references, tables, questionnaires and other annexures. It should be neatly typed in double line spacing on one side of the paper (A4 size, 8.27" x 11.69") and bound correctly. The 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), six 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 the 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.

12. **Guide**

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

DM/DNB / PhD in Renal Dialysis Technology in Nephrology and two years teaching experience after the PG qualification in a recognized Institution, **or** M.Sc in Renal Dialysis Technology with five years of teaching experience after the postgraduate qualification from a recognized Institution.

In view of the acute shortage of teachers in this new speciality, those having three years of 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.

The age of the guide/teacher shall not exceed 60 years. The guide student ratio shall be 1:5.

13. Schedule of examination

University Examinations will be held in two parts - Part I and Part II, at the end of the First-year and the end of the second 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 examination 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.

Carryover: A candidate who has appeared in all the subjects of the first year in the university examination is eligible to go to the Second year provided he/she has passed in any Three 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

14. Scheme of examination

a. 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 a minimum of two internal assessment examination in 1st year & subject of speciality 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.

b. 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: -

The written examination shall consist of five theory papers each of three hours duration. Each paper shall carry 100 marks.

Practical examination: -

There shall be **one** practical examination in the first year.

Viva- voce: - This shall aim at assessing depth of knowledge, logical reasoning, confidence & oral communication skills. Total marks shall be 40 marks. Both internal & external examiners shall conduct the viva- voce.

The particulars of subjects for examination and distribution of marks are shown in Table – V and VI.

Table-

V: Examination and Distribution of marks for Subjects of Specialization in the First-Year M.Sc RDT

Sl. No	Subjects	Theory		Practical			Sub Total
		University Exam	IA	Practical	IA	Viva voce	
1	Renal Anatomy and physiology	100	20	No Practical			120
2	Pharmacology in Renal Diseases	100	20	No Practical			120
3	Basics in Renal Replacement therapies	100	20	100	20	40	280
4	Imaging in Kidney Disease	100	20	No Practical			120
5	Biostatistics and Research Methodology	100	20	No Practical			120
	Total						**760**

*Records -To be assessed by the external examiners during University Practical examination.

Table-VI: Examination and Distribution of marks for Subsidiary Subjects- First-year M.Sc. RDT

Subsidiary subjects

Sl No	Course titles	Theory	IA	Total
1	Nutrition	100	20	120
	Total			**240**

**** examination to be conducted by respective**

colleges ii. Second year

Written examination: -

The written examination shall consist of four theory papers each of three hours duration. Each paper shall carry 100 marks.

Practical examination: -

There shall be **two** practical examinations in the Second year.

Viva- voce: - This shall aim at assessing depth of knowledge, logical reasoning, confidence & oral communication skills. Total marks shall be 40 marks. Both internal & external examiners shall conduct the viva- voce.

The particulars of subjects for examination and distribution of marks are shown in Table – VII and VIII.

Table-VIII: Examination and Distribution of marks for Subjects of Specialization in the Second Year M.Sc RDT

Sl. No	**Course title**	**Theory**		**Practical**			
		University Exam	**IA**	**Practical**	**IA**	**Viva Voce**	**Total**
1	Clinical Nephrology	100	20	No Practical			120
2	Biomedical instrumentation and Dialysis equipment	100	20	100	20	40	280
3	Advancements in Extracorporeal Therapies	100	20	100	20	40	280
4	Renal transplantation- Basic concept	100	20	No Practical			120
5	**Project / Thesis/ Dissertation**						
	Total						**800**

Table-VI: Examination and Distribution of marks for subsidiary Subjects- Second-year M.Sc RDT.

Subsidiary subjects

Sl No	Course titles	Theory	IA	Total
1	Emergency Medicine/ACLS	100	20	120
2	Hospital management & Quality in a healthcare	100	20	120
	Total			**240**

**** Examinations to be conducted by respective colleges**

15. Pass criteria

Theory

Theory 50%, which includes marks, obtained in written examination and internal assessment.

Practical

Practical 50% which includes marks obtained in the practical examination, viva-voce, internal assessment and records.

A candidate has to pass in theory and practical separately to pass in a subject in the university examination.

16. Declaration of Class

a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than60% of total marks prescribed will be declared to have passed the examination in Second Class.

d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

e. The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.

17. Eligibility for the award of Degree

A candidate shall have passed in all the subjects of first and second-year exams, then eligible for the award of the Degree.

18. Distribution of Type of Questions and Marks for Various Subjects

THEORY

SUBJECTS HAVING MAXIMUM MARKS= 100 Marks		
Type of Questions	**No. of Questions**	**Marks for Each Question**
Essay Type	3 (2 x 10)	10
Short Essay Type	12 (10 x 5)	05
Short Answer Type	12 (10 x 3)	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

19. Minimum requirement of Infrastructure, facilities for M.Sc. RDT course

Necessary Infrastructure applicable to the speciality:

Institute should have its Hospital with full-fledged Nephrology department. The facilities, as mentioned above, fulfil the minimum workload criteria for each of the subject speciality mentioned hereunder.

1. Dialysis Unit :

a. Minimum Ten Haemodialysis Machines
   - Minimum 20 haemodialyses per day

b. Active CAPD program with APD machines
   - Minimum 5 patients on CAPD program

c. Intensive care unit with CRRT machines
   - 10 Bed ICU facility with full-time intensives Care, doctors, d. Pediatric Dialysis

e. Active transplant program
   - 08-20 Kidney transplants per year

f. One Full-time nephrologist

g. Procedure room/OT for

- Central venous catheter insertion (5 procedures per month)
- Arteriovenous access surgery(5 surgery per month)
- Kidney biopsy (5 biopsies per month)

2. Infrastructure and types of equipment required:

a. Classroom with capacity for 20 students.

b. Water treatment plant for Dialysis

c. HD machines

d. Defibrillators

e. Cardiac monitors

f. ECG machines

g. APD machines

h. CRRT Machines

i. Dialyser Reprocessors

3. Minimum workload criteria for conducting this course

a. Haemodialysis- 500 / per month

b. Peritoneal Dialysis – 5 Patients

c. Kidney Biopsy – 5/ month

d. IJC/Tunneled catheter insertion- 5 / month

e. Renal Transplant -08/ Year

First Year M.Sc Renal Dialysis Technology

Paper 1: RENAL ANATOMY AND PHYSIOLOGY

Anatomy of Urinary Tract & Kidney

1. **Basic anatomy of urinary system**
   a. The Kidney (structural anatomy)
   b. The ureter
   c. the bladder
   d. The urethra
   e. Sphincters
   f. Prostate
   g. Renal Vasculature
2. **Gross anatomy of the kidney** a. Location of kidney
   b. Size
   c. Protection
   d. Structure of the Kidney – gross structure blood supply, nerve supply, lymphatic flow, LS of Kidney.
3. **Microscopic anatomy**
   a. Nephron : Glomerular structure, tubules
   b. Interstitium
   c. Juxta Glomerular apparatus
4. **Embryology and fetal development in brief**
5. **Composition and function of blood** – **Introduction**
   a. Red blood cells: Erythropoiesis, stages of differentiation function, count physiological variation.
   b. Haemoglobin: structure, functions, concentration physiological variation methods of Estimation of Hb
   c. White blood cells: Production, function, life span, count, differential count
   d. Platelets: Origin, normal count, morphology functions.
   e. Plasma Proteins – Production, concentration, types, albumin, globulin, Fibrinogen, prothrombin functions
   f. Hemostasis & Blood coagulation: Hemostasis: Definition, normal hemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.
   g. Blood Bank: Blood groups –
      ABO system, Rh system
      Blood grouping & typing
      Cross matching
      Rh system – Rh factor, Rh in compatibility
   h. Blood transfusion – Indication, universal donor and recipient concept

i. Selection criteria of a blood donor. transfusion reactions Anticoagulants – Classification, examples and uses
j. Anemia's: Classification – morphological and etiological. Effects of anaemia on body
k. Erythrocyte sedimentation rate (ESR) and Packed cell volume
l. Blood Volume: Normal value, determination of blood volume and Regulation of Blood
Volume
m. Body fluid: pH, normal value, Regulation and variation
n. Lymph: lymphoid tissue formation, circulation, composition and function of the lymph **Nephrophysiology**

1. Introduction to physiology:
   a. The cell and general physiology
   b. Functional organization of the human body and control of the "Internal Environment." c. Homeostasis
   d. Regulation of body functions

2. Nephro Endocrinology
   a. The thyroid metabolic hormones
   b. Insulin, Glucagon and diabetes mellitus:
   c. Insulin and its metabolic effects Glucagon and its functions
   d. Parathyroid hormone, Calcitonin, calcium and phosphate metabolism, vitamin D, e. The function of Vitamin D
   f. Erythropoietin
   g. Bone and its relationships to extracellular calcium and phosphates
   h. Parathyroid Hormone
   i. Calcitonin – overall control of calcium Ion concentration – physiology of parathyroid and bone diseases
3. Kidneys and body fluids
   a. The fluid body compartments: extracellular and intracellular fluids interstitial fluid and oedema

      - Body fluid compartments
      - Constituents of extracellular and intracellular fluids
      - Osmotic equilibrium and fluid shifts between the extracellular and intracellular fluids
      - Changes in the volumes and osmolality of the extracellular and intracellular fluid compartments in the abnormal state
      - Pathology of Oedema

   b. Formation of urine by the Kidney: Renal Blood Flow, Glomerular filtration and their control.
      - physiologic anatomy of the Kidney
      - The basic theory of nephron function
      - Renal blood flow and pressures

- Glomerular filtration and renal plasma flow
- 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 extracellular fluid volume
    - Urea excretion
    - Potassium excretion
    - Control of the extracellular concentrations of other ions

f. Regulation of Acid-Base Balance
    - The 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 – Physiology

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Renal Anatomy and Physiology** shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS- 100			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			**100**

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

Distribution of Marks for University Theory and Practical Exam

Theory			Practical			Total
Theory	IA	Total	Practical	IA	Total	
100	**20**	**120**	**-**	**-**	**-**	**120**

Reference Books:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaursia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd
7. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers Chatterjee (CC)
8. Human Physiology Latest Ed. Vol. 1, Medical Allied Agency Choudhari (Sujith K)
9. Concise Medical Physiology Latest Ed. New Central Book Ganong (William F) Review of Medical Physiology. Latest Ed.

Paper 2: PHARMACOLOGY IN RENAL DISEASES

Pharmacology

1. **Normal drug activity**
    a. Physiologic state
    b. Compliance
    c. Drug Characteristic
    d. Pharmacokinetics
    e. Pharmacodynamics
    f. Pharmacotherapeutics
    g. Adverse effect
    h. Lethal dose
2. **Effects of renal failure on drug activity**
    a. Physiologic state
    b. Compliance
    c. Drug Characteristic
    d. Pharmacokinetics
    e. Pharmacodynamics
    f. Pharmacotherapeutics

3. **Medications commonly used by the patient with renal failure**
4. **- classification, Therapeutic use,**
   Dosage, Mechanism of action, side effects, route of administration,
    a. Antacids and phosphate binders
    b. Anti anaemic drugs
    c. Anticoagulants
    d. Antihypertensives and diuretics
    e. Antimicrobials
    f. Antipruritics
    g. Cardiovascular drugs
    h. Chelating agents
    i. Electrolytes imbalance treatment
    j. Growth hormone
    k. Laxatives and
    l. Local anaesthetics
    m. Potassium ion exchange resin
    n. Thrombolytic agents
    o. Vitamins
    p. Immunosuppressants
    q. Vaccines and sera
        - Dialysis
        - Transplant

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Pharmacology in Renal Diseases** shall be as given under

SUBJECTS HAVING MAXIMUM MARKS- 100			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			**100**

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

Distribution of Marks for University Theory and Practical Exam

Theory			**Practical**			**Total**
Theory	IA	Total	Practical	IA	Total	
100	**20**	**120**	**-**	**-**	**-**	**120**

Reference books:

Essentials of Medical Pharmacology - Tripathi

Basics and Clinical Pharmacology - Katzung

Paper 3: BASICS IN RENAL REPLACEMENT THERAPIES

1. History of haemodialysis and peritoneal Dialysis
2. Basic principles of hemodialysis and peritoneal Dialysis
3. Hollow fibre dialyser: technical and clinical consideration
    - Biocompatibility
    - Membrane types
    - Advanced Dialyser Membranes
    - Flux of the membrane
    - KoA
    - Kuf
    - Clearance
    - Sterilisation method
4. **Dialysate composition**
    a. Blood electrolytes Vs dialysate composition
    b. Mixing ratios
    c. Dilution factors
    a. Composition of Dialysate
    b. Proportioning system
    c. The safety system in dialysis solution mixing and delivery system
    d. Bicarbonate precipitation
    e. Citrate and Acetate based solutions

5. **Water Treatment Plant**

    a. Feed Water Components in detail
    b. Pre-treatment Components in detail
    c. RO System in detail
    d. Ultrafilters
    e. Cartridge filters
    f. De ionization in detail
    g. Distribution System in detail
    h. Bacteria and Endotoxin Bacteria testing of product water
    i. Chemical analysis

6. **HD machines Saftey Alarms**
    a. Inflow pressure(Prepump Pressure)
    b. Outflow Pressure (Venous Pressure)
    c. TMP
    d. Air bubble detector
    e. Conductivity
    f. Blood leakage
    g. Temperature

Vascular access

A. History of vascular access
B. Types of vascular access
C. Arteriovenous Access
a. Guidelines targeting increased use of AV fistula
b. Vessel Preservation.
c. Arteriovenous access planning
    - Patient education and timing issues.
    - Predicting the need for Dialysis

d. Preoperative evaluation
    - Patient history.
    - Physical examination:
    - Imaging studies.
        - Doppler ultrasonography.
        - Venography.
        - Arteriography.
e. Surgical locations for AV Fistula and AV Graft
f. Operative procedure for and AV fistula
g. Perioperative care and fistula maturation
h. ARTERIOVENOUS GRAFTS
    - Potential AV graft locations
    - Surgical placement
    - Postoperative care
    - Maturation ○ Early-use grafts.
        - Autologous tissue grafts
i. Physical Examination of AV Fistulas and Grafts.
        - Inspection
        - Palpation and auscultation
    - Pulse
    - Thrill
    - Auscultation
    - Pulse augmentation and arm elevation tests
j. General issues relating to cannulation of either AV fistulas or grafts
    - Skin preparation
    - Anaesthesia
    - Use of tourniquets for AV fistulas.
    - Needle size
    - Needle position, spacing, and orientation
    - Risk of inflow/outflow needle reversal
    - Buttonhole cannulation and rope ladder
    - Preventing and dealing with infiltration

- Hemostasis post-dialysis
- New synthetic grafts and early access

k. AV access monitoring and complications

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

l. Access recirculation

m. Neointimal hyperplasia.

D. Venovenous access

- Types of catheter
- Choice of device
- Catheter placement
- Selected Factors Favoring Different Temporary (Nontunneled) Hemodialysis Catheter Insertion Sites
- Placement techniques
  - External jugular vein
  - Internal jugular vein
  - Femoral vein
- Placement under radiographic guidance –Ultrasound
- Uncuffed versus cuffed catheter use
- Care and use of Venous catheters
  - Dressing
  - Catheter locks
- Insertion-related complications
- The Centers for Disease Control Core Interventions for Dialysis Bloodstream Infection (BSI) Prevention
- Venous catheter infections and other Complications
  - Infections
  - Poor catheter flow (catheter dysfunction)
  - Thrombosis
  - Central venous stenosis
  - Catheter adhesion

E. Non-surgical methods for salvaging failed dialysis access

F. Nursing care for the patient with dialysis access.

G. Improving vascular access outcomes

8. **Dialysis prescription**

a. Acute renal failure

- Determining dialysis session length and blood flow rate
- Dialysis frequency and dose for subsequent treatments and dialysis adequacy
- Choosing a dialyzer
- Dialysis fluid Electrolyte selection criteria – Sodium, Potassium, Calcium, Magnesium, Phosphorus and dextrose
- Dialysis duration
- Dialyser selection
- Ultrafiltration orders

b. Chronic renal failure

- Dose of Dialysis in terms of urea removal for thrice-weekly Dialysis • Adequacy targets for schedules other than three times per week
- Adequacy targets based on metrics other than urea removal.
- Writing the initial haemodialysis prescription
- The Initial Prescription for a Specific Patient to Achieve a Desired *spKt/V*. • How weight change during Dialysis affects the dialysis prescription
- Checking the delivered dose of Dialysis.
- FLUID REMOVAL ORDERS
  - Concept of "dry weight" or optimum post-dialysis weight
  - Frequent resetting of the optimum post-dialysis weight
  - Fluid removal rate.
- Dialysis solution flow rate
- Dialysis solution composition
  - Bicarbonate
  - Sodium
  - Potassium
  - Calcium
  - Magnesium
- Laboratory investigation for Patients on Dialysis.

9. **Dialyser Reuse**
10. **Anticoagulation**
    a. Coagulation cascade
    b. Administration of Heparin during Dialysis
    c. Methodology
    d. Anticoagulation tests
       - Whole blood clotting time
       - Whole Blood activated clotting time
       - Whole Blood partial thromboplastin time

e. Principles of anticoagulation
f. Complications of Heparin therapy
g. Heparin free Dialysis
h. Other anticoagulants
i. Regional citrate anticoagulation
j. Recent advancement and study related to anticoagulation used during Dialysis

11. **Complications during Haemodialysis**
    a. Intradialytic Hypotension
    b. Muscle Cramps
    c. Nausea and Vomiting
    d. Headache
    e. Chest Pain and Back Pain
    f. Itching
    g. Disequilibrium Syndrome
    h. Dialyser Reactions
    i. Hemolysis
    j. Air Embolism
    k. Cardiac Arrest
    l. Arrhythmia
    m. Cardiac tamponade
    n. Seizures
    o. Intracerebral bleed

12. **Urea Kinetic Modeling**
    a. SOLUTE REMOVAL FROM THE PERSPECTIVE OF THE DIALYZER.
        - Extraction ratio.
        - Concept of clearance.
            - Effect of dialyzer blood flow rate on clearance.
            - The *K*0*A*, mass transfer area coefficient.
            - Calculating the solute removal rate.
            - Effect of erythrocytes.
            - Effect of blood water.
            - Effect of dialysis solution flow rate.
            - Effect of molecular weight on diffusive clearance.
            - Very large molecules.
            - Dialyzer efficiency versus flux.
    b. SOLUTE REMOVAL FROM THE PATIENT PERSPECTIVE
        - Importance of urea.
        - The weekly serum urea nitrogen profile.
        - Pitfalls in targeting a predialysis SUN or TAC SUN
        - Indices of urea removal ○ Urea reduction ratio (URR) ○ *Kt*/*V* urea.

- How URR is related to *Kt/V*
- fish tank model
- Effect of urea generation.
- Additional *Kt*/*V* associated with volume removal
- Multipool models, urea inbound, and rebound ✞ Regional blood flow model.
    - ✞ Implications of urea inbound and rebound on measures of adequacy.
    - ✞ The concept of equilibrated *Kt/V* (e*Kt/V*).

c. ACCESS RECIRCULATION.
- Impact of access recirculation on dialysis adequacy
- Avoiding the impact of access recirculation on URR or sp*Kt/V* by slowing the blood flow

d. CARDIOPULMONARY RECIRCULATION.
- Impact of cardiopulmonary recirculation on dialysis adequacy

e. MODELING OF UREA DISTRIBUTION VOLUME.
- *V* much smaller than usual.
- *V* much larger than normal.

f. UREA NITROGEN GENERATION RATE (*g*) AND THE nPNA

g. RESIDUAL RENAL FUNCTION.
- Measuring the *K*ru.

h. STANDARD *Kt/V* UREA.
- Casino Lopez EKRU
- Standard *Kt/V* urea.
- Issues relating to normalizing by *V*

i. MACHINE-ESTIMATED MEASURES OF HEMODIALYSIS ADEQUACY
- Estimating dialyzer clearance by pulsing dialysate with sodium and analyzing resulting changes in dialysate conductivity.
- UV absorbance of spent dialysate

13. **Concepts & Principles of Peritoneal Dialysis**

a. Advantages of PD
b. Anatomy and physiology of peritoneal dialysis
c. Apparatus for Peritoneal dialysis
d. Peritoneal access devices
- Acute and chronic catheters
- Catheter selection
- Catheter placement procedures.
- Special access procedures
    - Extended catheters
    - Catheter embedding procedure.

- Catheter break-in procedures
- Acute complications of catheters
- Complications of chronic peritoneal catheters
- Catheter infection and management.
- Care of the chronic peritoneal catheters
- Catheter removal and secondary embedding

e. Peritoneal Dialysis for the treatment of acute kidney injury

- Indication.
- Technical aspects.
- Advantages and Disadvantages of Peritoneal Dialysis in Acute Kidney Injury
- Complications.

f. Adequacy of Peritoneal Dialysis and chronic PD prescription

- Modalities of peritoneal dialysis therapy
- CHOICE OF A PRESCRIPTION
  - Clearance targets
  - Measurement of clearance
  - Determinants of clearance
  - Prescription strategies to achieve clearance targets in chronic peritoneal dialysis
  - Incremental versus maximal prescription.
  - Empirical versus modeled approach.
  - Prescription pitfalls in peritoneal dialysis.
- GLUCOSE-SPARING STRATEGIES.
- NUTRITIONAL ISSUES IN PERITONEAL DIALYSIS. • PET- Peritoneal Equilibration Test

g. Volume status and fluid overload-Ultrafiltration failure(UFF)- in Peritoneal Dialysis

- Diagnosis and classification of peritoneal membrane dysfunction and ultrafiltration failure (UFF)
- Recent advancement and studies related to UFF and management h. Peritonitis • Pathogenesis
- Etiology.
- Diagnosis.
- Treatment
  - Initial management ○ Choice of antimicrobial therapy.
  - ○ Delivery methods and schedules for antimicrobial drugs ○ Heparin. ○ Nystatin.
  - ○ Alterations in schedule for CAPD and APD. ○ Consideration of secondary peritonitis. ○ Amylase and lipase.

- Consequence of changes in peritoneal permeability ○ Constipation.
- Initial management of peritoneal contamination without peritonitis.
- Change in management of peritonitis based on patient course and initial culture results.
- Refractory peritonitis and indications for catheter removal.
- Relapsing, recurrent, and repeat peritonitis
- Peritonitis with catheter obstruction ● Prophylactic antibiotic use ● Prevention.

i. EXIT-SITE AND TUNNEL INFECTION
   - Incidence.
   - Etiology and pathogenesis.
   - Therapy.
   - Prevention

j. Hernia, leaks and encapsulating peritoneal sclerosis in Peritoneal Dialysis (mechanical complications)

k. Recent advancement and studies related to complications of Peritoneal Dialysis and management

l. Metabolic, Acid-base and electrolyte aspects of Peritoneal Dialysis (Metabolic complications)

m. Recent advancement and studies related to Metabolic complications and management
n. ISPD guidelines

o. Patient training and Setup for Home PD

14. **Kidney transplantation**

a. Legal aspects of organ donation
b. Documentation and paperwork for donor and recipient
c. Cadaver transplant- registration, patient selection criteria. Policies and procedures
d. Blood group antigen and antibody
e. ABO-incompatible kidney transplantation
f. Antibody depletion by extracorporeal
   - Therapeutic plasma exchange, DFPP and Immuno-adsorption: techniques, circuit preparation and procedure
   - Indications for Dialysis and TPE in post kidney transplant

15. **Technological advances in renal replacement therapy**

a. Dialyser and membrane technology
b. Vascular access
   - Double lumen catheters
   - AVF needles
c. Artificial Kidney/wearable Kidney
d. Sorbent technology
e. Online HDF

f. CRRT

16. **Renal Nutrition**

a. Cause of protein-energy wasting (PEW) in CKD patients.
    - Obesity
    - Nutritional assessment

b. Patient interview and physical examination
    - Assessment of food intake
    - Nutritional screening tools
    - Nutritional assessment tools
    - Body composition
    - Composition indices
    - Laboratory tests
    - Dietary requirements

c. Need for individualization

d. Peer rather than actual body weight

e. Adequacy of Dialysis
    - Protein
    - Energy
    - Per cent carbohydrate
    - Lipids
    - Sodium and water
    - Potassium
    - Calcium and phosphorus
    - Vitamins

f. Nutrient requirement in hospitalized patients with kidney disease
    - Energy requirements in hospitalized dialysis patients
    - Protein requirements
    - Lipid requirements
    - General comments
    - When to initiate nutritional supplements
    - Oral supplements

g. Interdialytic total parental nutrition (IDPN)in haemodialysis
    - Indication and benefits
    - Composition, infusion and complications
    - The potential risk of IDPN

h. Total parental nutrition (TPN)
    - Carbohydrates
    - Amino acids

- Lipids
- Electrolytes
- Vitamins
- Minerals and trace elements

i. Intraperitoneal infusion of amino acids in peritoneal dialysis patients
   - Indication and benefits
   - Composition, infusion, and complications
   - Adjuvant therapies and exercise

j. Diet planning for CKD & ESRD patients

PRACTICAL – Paper 3: Basics in Renal Replacement therapies

- Patient assessment Haemodialysis
- Vascular access management
- Calculation of Adequacy • Peritoneal dialysis exchanges
- Dialysis in ICU.
- RO water treatment system, Monitoring
- Sample collection for water culture, endotoxin and chemical analysis
- RO plant disinfection.
- Profile- Sodium and UF
- Variable bicarbonate settings and indication
- Isolated UF settings and indications
- Advanced options – BVM, BTM and Single-needle Haemodialysis
- APD Machine settings
- PET test (Peritoneal Dialysis)
- Adding medicines in PD bags
- Assisting Venovenous catheter insertion

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Basics in Renal Replacement therapies** shall be as given under

SUBJECTS HAVING MAXIMUM MARKS- 100 Marks			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			**100**

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

SCHEME OF EXAMINATION – PRACTICAL

The scheme of examination for **Basics in Renal Replacement therapies** Practical shall be as follows:

Distribution of marks

Type of questions	Marks allotted
Spotters	40
Practical	50
Viva	40
Record	10
IA	20
Total	**160**

Distribution of Marks for University Theory and Practical Exam

Theory			**Practical**				**Total**
Theory	IA	Total	Practical	IA	Viva Voce	Total	
100	**20**	**120**	**100**	**20**	**40**	**160**	**280**

Reference books:

1. Handbook of Dialysis – 5th Edition – John T Daugirdass
2. Handbook of dialysis therapy – Allen R Nissenson 3. Core curriculum for dialysis technician- ANNA
4. KDOQI guidelines.

5. www.uptodate.com
6. Journal: American Journal of Kidney disease
7. Journal: Nephrology Dialysis Transplantation

Paper 4: IMAGING IN KIDNEY DISEASE

1. Ultrasound:
    a. Elementary ultrasound methodology
    b. Sonographic imaging characteristics
    c. Doppler ultrasound-scanning techniques
    d. Ultrasound of the Normal Kidney
    e. Ultrasound versus intravenous contrast studies
    f. Doppler ultrasound in the evaluation of renal vascular Disease –
    g. Evaluation of anatomic abnormalities.
    h. Vascular access assessment: ultrasound and Doppler – AVG and AVF

2. Computed Tomography Of The Kidney:
    a. Indications
    b. Technique

3. Magnetic Resonance Imaging:
    a. Technical aspects
    b. Magnetic resonance with iv contrast
    c. Normal Kidney
    d. Congenital anomalies

4. Renal Angiography:
    a. Indications
    b. Relative contraindications
    c. Patient preparation
    d. Basic procedure
    e. Specific techniques
    f. Complications
    g. Angioplasty
    h. Renal artery stents
    i. Transcatheter embolization.
5. Nuclear Medicine
    a. DMSA Scan–Injections
    b. DTPA Scan- GFR Assessment

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Imaging in Kidney Disease** shall be as given under

SUBJECTS HAVING MAXIMUM MARKS- 100 marks			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			**100**

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

Distribution of Marks for University Theory and Practical Exam

Theory			Practical			Total
Theory	IA	Total	Practical	IA	Total	
100	**20**	**120**	**-**	**-**	**-**	**120**

Referance Books:

- Basics in Renal Replacement therapies - Emilio Quaia
- Brenner and Rector's The Kidney- Maarten W. Taal, Glenn M. Chertow, Philip A. Marsden

Paper 5: BIOSTATISTICS AND RESEARCH METHODOLOGY

Biostatistics

1. **Introduction**
    a. What is statistics
    b. Importance of statistics in behavioural sciences
    c. Descriptive statistics and inferential statistics
    d. Usefulness of quantification in behavioural sciences
2. **Measurements:**
    a. Scales of measurements
    b. Nominal, Ordinal, Interval and Ratio scales. Data collection
    c. Classification of data – Class intervals
    d. Continuous and discrete measurements
    e. Drawing frequency polygon
    f. types of frequency polygon
    g. Histogram
    h. Cumulative frequency curve
    i. Drawing an inference from the graph
3. **Measures of central tendency** – Need – types: Mean, Median, Mode – Working out these measures with illustrations.
4. **Measures of variability :**
    a. Need – Types: Range,
    b. Quartile deviation, Average deviation,
    c. Standard deviation,
    d. Variance – Interpretation.
5. **Basic probability distributions and sampling distributions:**
    a. Concept of probability and probability distribution.

b. Normal, Poisson and Binomial distributions, parameters and application

c. Concept of sampling distributions. Standard error and confidence intervals. d. Skewness and Kurtosis.

e. Variants from the normal distribution:

- Skewness
- Quantitative measurement of skewness
- kurtosis – the measurement of kurtosis
- Factors contributing to non-normal distribution.

6. Tests of significance:

a. Basics of testing of hypothesis, Null and alternate hypothesis, type I and type II errors, level of significance and power of the test, P-value.

b. Tests of significance (parametric)- **T-**test (paired and unpaired), Chi-square test and test of proportion,

c. Analysis of variance. Repeated measures analysis of variance. Friedmann's analysis of variance.

d. Tests of significance (non-parametric)-Mann-Whitney u test, Wilcoxon test, Kruskal-Wallis analysis of variance

7. Correlation and regression:

a. Simple correlation

b. Pearson's and Spearman's

c. Testing the significance of correlation coefficient linear and multiple regression

8. Multivariate Analysis:

a. Concept of multivariate Analysis, introduction to logistic regression and survival analysis

Research methodology

1. Introduction:

a. Introduction to biostatistics and research methodology

b. Types of variables and scales of measurements

c. Measures of central tendency and dispersion

d. Rate, ratio, proportion

e. Incidence and prevalence

2. Sampling:

a. Random and non-Random sampling

b. Various methods of sampling

c. Simple random, stratified, systematic, cluster and multistage

d. Sampling and non-sampling errors and

e. Methods of minimizing these errors

3. Study designs

a. Descriptive epidemiological methods
b. Case series analysis and prevalence studies
c. Analytical epidemiological methods
d. Case-control and cohort studies
e. Clinical trials/intervention studies, Odds ratio and relative risk, stratified Analysis

4. Sample size determination:

a. The general concept, the sample size for estimating mean and proportion
b. testing of difference in means and proportions of two groups

5. Reliability and validity evaluation of diagnostic tests.

6. Format of scientific documents.

a. Structure of research protocol, the structure of the thesis/research report,
b. Formats of reporting in scientific journals. Systematic review and meta-analysis.

Reference Books:

1. Cooper R Donald, Schindler S Pamela (2001) – Business Research Methods, Tata McGraw Hill Publications Ltd, New Delhi
2. Gupta S P Statistical Methods, Sulthan Chand & Sons New Delhi
3. Kothari C R.- Research Methodology – Methods and Techniques 4. Norma G Reid – Research Methodology & Statistics in Healthcare.
5. Mike Luck – Research in Healthcare.
6. Weiss, N.A., Introductory Statistics. Addison Wesley, 1999.
7. Gupta. SC and Kapoor. VK Fundamentals of Mathematical Statistics, Sultan Chand and sons,

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Biostatistics and Research Methodology** shall be as given under

SUBJECTS HAVING MAXIMUM MARKS- 100 (for Second Year B.Sc)			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			100

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

Distribution of Marks for University Theory and Practical Exam

Theory			Practical			Total
Theory	IA	Total	Practical	IA	Total	
100	**20**	**120**	**-**	**-**	**-**	**120**

Subsidiary subjects

Paper 1: Nutrition

1. Nutrition

a. Introduction to the science of nutrition

b. Nutrition and its relation to health
c. Nutrition and immunity
d. Factors affecting nutritional status

2. Classification of nutrients, functions, Digestion, absorption &their role in health

a. Macronutrients
b. Carbohydrates
c. Protein
d. Lipids
e. Micronutrients
f. Minerals
g. Vitamins

3. Basic food groups and Nutritive value

a. Nutritive value of cereals
b. Nutritive value of Pulses
c. Nutritive value of NUTS & oilseeds
d. Nutritive value of animal foods
e. Nutritive value of milk and milk products
f. Nutritive value of vegetables and fruits

4. Water

a. Distribution & fluid balance in the body

5. Clinical Dietetics

a. Nutritional and food requirements of different age groups
b. Recommended dietary allowances
c. Balanced diet
d. Meal planning
e. Therapeutic diets
f. Routine hospital diets
g. Special feeding methods
h. Food and Drug interaction

6. Medical Nutritional Therapy in various Disease conditions

a. Gastrointestinal disease
b. Diseases of liver and pancreas

c. Nutritional anemia
d. Diabetes mellitus
e. Disease of kidneys
f. Cardiovascular disease
g. Cancer
h. Food sensitivity

7. Principles of nutritional assessment

a. Anthropometric assessment
b. Clinical examination
c. Laboratory and Biochemical Assessment
d. Dietary Assessment

Reference Books:

1. Dietetics 7th Edition – B Srilakshmi
2. Human Nutrition- B Srilakshmi

Scheme of Examination

Written (Theory): Maximum Marks: –100 marks.

No Practical or Viva-voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is **35 marks

Second-year MSc Renal Dialysis Technology

Paper 1: CLINICAL NEPHROLOGY

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. Aetiology, 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

7. 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
8. Renal Transplantation:
    a. Epidemiology and outcomes
    b. Renal Transplantation: Donor and Recipient Evaluation
    c. Renal Transplantation: Classification and consequences of Rejection
    d. Renal Transplantation: Immunosuppression Complications of Renal Transplantation

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
10. Nephropathology
    a. Pathogenic Mechanisms in Renal Diseases
        - Glomerulus
        - Tubular and intestinal
        - Vascular
    b. Pathogenic Findings
        - Light Microscopy
        - Immunofluorescence Microscopy
        - Electron Microscopy
        - Aetiology/pathogenesis
        - Clinicopathologic correlations

Clinical problems in patients on Dialysis:

11. Hypertension in the dialysis patient
    Definition and Measurement

a. Pathophysiology
b. Treatment
    - Prevention
    - Correction of salt and fluid overload
    - Clinical assessment of dry weight.
    - Intradialytic Hypertension
c. Common clinical problems
d. Antihypertensive drug use.
e. Hypertensive urgencies and emergencies

12. Diabetes in the dialysis patient
    a. Dialysis modalities for Diabetes
    b. Hyperkalemia
    c. Cardiovascular Disease and hypertension
    d. Cerebrovascular Disease
    e. Eye problems in people with Diabetes on Dialysis
    f. Impotence
13. Bone diseases in dialysis patients
    a. Pathophysiology
    b. Bone disease in CKD
    c. Control of hyperphosphatemia
    d. Optimizing serum calcium
    e. Parathyroid hormone levels
    f. Aluminium toxicity
14. Infections
    a. Derangement of immune functions in Uremia
    b. Derangement of temperature control in Uremia
    c. Bacterial infections in dialysis patients
    d. Viral infections
    e. Vaccinations

Infection control practices in Dialysis

a. Health care practices and CDC recommendations
b. Indian society of Nephrology guidelines
c. Patient training related to vascular access; venovenous and arteriovenous
d. Staff training related to vascular access management
e. Preventions of seroconversion in Hemodialysis unit
f. Staff safety and universal precautions
g. Peritoneal dialysis patients home training to reduce the incidents of Peritonitis and exit site infections
h. Cleaning and disinfection of dialyzer and preventions of cross-contamination and infections
i. Machine cleaning and disinfection
j. Prevention of contaminations in Dialysis water treatment, storage and delivery system

13. Hematologic abnormalities
    a. Anaemia
    b. Haemolysis
    c. Disorder of Haemostasis
14. Nervous system and sleep disorder
    a. Intracranial bleeding and ischemic stroke
    b. Subclinical brain structural abnormalities
    c. Diagnosis and management of epileptic seizures
    d. Partial Differential Diagnoses of Chronic Dementia in Dialysis Patients
    e. Seizures in Dialysis Patients
    f. Sleep-related disorders
    g. Peripheral neuropathy.
15. Cardiovascular Disease
    a. Traditional risk factors
    b. Left ventricular hypertrophy
    c. Non-traditional risk factors
    d. Ischemic heart disease
    e. Cardiomyopathy and heart failure
    f. Pericardial Disease
    g. Valvular Disease
    h. Valvular calcification and stenosis
    i. Ventricular arrhythmias, cardiac arrest, and sudden cardiac death j. Stroke.
16. Obstetrics and Gynaecology in dialysis patients
    a. Birth control
    b. Pregnancy
    c. Dialysis regimen during pregnancy
    d. Dialysis modality
        - Intensive Dialysis
        - Dialysis solution calcium
        - Dialysis solution bicarbonate
        - Dialysis solution bicarbonate
        - Monitoring weight gain
    e. Monitoring weight gain
    f. Monitoring weight gain
    g. Labour and delivery
    h. Dyspareunia
    i. Dyspareunia
    j. Abnormal uterine bleeding.
    k. Hormone replacement therapy.
    l. Gynecologic neoplasms

14. Psychosocial issues and rehabilitation in Dialysis

a. Introduction

b. Depression

- Treatment options.
- Pharmacotherapy
- Selective serotonin reuptake inhibitors (SSRIs) and tricyclic antidepressants (TCAs)
- Selective norepinephrine reuptake inhibitors (SNRIs)
- Monoamine oxidase inhibitors (MAOIs)
- Nonpharmacologic options.

c. Dementia/delirium.

d. Anxiety and behaviour disorders.

e. Other psychosocial issues in the ESKD population

- Marital issues.
- Sexual dysfunction.
- Socioeconomic issues.

f. Rehabilitation.

g. Quality of life (QOL)

Reference Books:

1. www.uptodate.com
2. Chronic Renal Disease- Paul L. Kimmel, Mark E. Rosenberg – 2019
3. Brenner and Rector's The Kidney- Barry M. Brenner, Samuel A. Levine
4. Handbook of Dialysis - John T. Daugirdas, Peter G. Blake, Todd S. Ing
5. Fundamentals of Renal Pathology- Agnes B. Fogo, Arthur H. Cohen, Robert B. Colvin, Charles E. Alpers, J. Charles Jennette
6. Journals: American Journal of Kidney disease
7. Journals: Nephrology Dialysis Transplantation

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Clinical Nephrology** shall be as given under

SUBJECTS HAVING MAXIMUM MARKS- 100 marks			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50

Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			100

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

Distribution of Marks for University Theory and Practical Exam

Theory			Practical			Total
Theory	IA	Total	Practicals	IA	Total	
100	**20**	**120**	**-**	**-**	**-**	**120**

Paper 2: BIOMEDICAL INSTRUMENTATION AND DIALYSIS EQUIPMENT

A. BIOMEDICAL INSTRUMENTATION

1. Introduction to Biomedical Instrumentation
    a. The Age of Biomedical Engineering
    b. Development of BM instrumentation
    c. Biometrics
2. Introduction to the man-instrument system
    a. Components of the man-instrument system
    b. physiological systems of the body
    c. Problems encountered in measuring a living system.
3. Basic Transducer principles:
    a. The transducer and transduction principles
    b. Transducers for Biomedical applications
4. Sources of Bioelectric potentials:
    a. Resting and action potentials
    b. Propagation of Action potentials
    c. The Bioelectric potentials
5. Electrodes
    a. Electrode theory

b. Biopotential electrodes
c. Biochemical transducers

6. The computer in Biomedical Instrumentation:
    a. The digital computer - Computer Hardware, Computer software
    b. Microprocessors - Types of microprocessors, Microprocessors in Biomedical Instrumentation- Calibration
    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
7. Electrical safety of Medical Equipment
    a. Physiological effects of electrical current
    b. Shock hazards from electrical equipment.

8. **Dialysis & Electronics** a. Electricity
    b. Conductivity
    c. Electrical leakage
    d. Electronic components

B. DIALYSIS EQUIPMENT: FUNCTIONS, SAFETY CHECK, PREVENTIVE MAINTENANCE AND CLINICAL APPLICATIONS

9. Haemodialysis machines

a. Blood system
- Blood pump
    - Occlusion
    - Pump Segment setting
- Arterial pressure /Inflow line pressure
- Venous pressure/outflow line pressure
- Air bubble detector
- Saline/Blood detector

b. Dialysis solution system
- Flow diagram
- Water inlet valve/flow regulator
- Deaeration system
- Heat exchanger
- Acid and Bicarbonate mixing
- Supply pump
- Flow equalizer/ Balancing system/ Ultrafiltration controller
- UF Pump
- Flow sensors
- Valves
- Online production of ultrapure dialysis solutions

c. Safety system-Hydraulics
    - Inlet water pressure
    - Conductivity
    - Temperature
    - Flow monitoring
    - Leak test/pressure holding test
    - Blood leakage
    - Endotoxin filters / ultrafiltrers

d. Understanding the concept of calibration
    - Blood flow
    - Temperature and conductivity
    - Flow
    - Blood leakage
    - Air bubble sensor
    - Saline detectors

e. Basic requirements for machine installation
    - Power requirements
    - Water pressure
    - Water Flow
    - Drain lines
    - Central acid and bicarbonate line installations
    - Water quality

f. Machine disinfection
    - Purpose
    - Types of disinfectants
    - Disinfection program settings
    - Hot disinfection settings
    - Chemical dilution settings
    - External disinfection
    - Chemical residual test

g. Online HDF Machine
    - Monitoring quality of water
    - Advantage of Online HDF
    - Endotoxin filters change and frequency.

h. Advanced features
    - Profiles
    - Online Clearance Monitoring

- Blood Temperature Monitoring
- Vascular Access Recirculation monitoring
- Therapeutic Software
- Single needle dialysis

10. CRRT machines

- Different types of equipment and comparison
- Treatment modalities and settings; compare the different modalities.
  CVVH
  CVVHD
  CVVHDF
  SCUF
  TPE
  MARS
- Blood pumps
- Predilution and post-dilution
- Dialysate pumps
- Heater Module
- Blood and dialysate system flow diagrams in different CRRT machines
- Comparison of CRRT machines available in India
- Load scales – frequency of calibration

Safety

- Blood leakage
- TMP
- Filter pressure
- Leak sensors
- Pressure alarms

11. Dialyzer reprocessor

a. Machine installation
   - Power requirements
   - Water quality, flow, pressure etc
   - Disinfectants
   - Cleaning agents
   - Drain lines

b. Basic functions of the machines
   - Flow diagram
   - Settings
   - PM

- Software integration

c. Calibrations

12. APD machines

a. Basic settings
b. The setting for different treatment modalities
c. Nurses menu
d. Online Monitoring of APD Prescription

13. Central delivery system

a. Acid and bicarbonate system maintenance
b. Understand basic water flow diagrams
c. Pumps and valves
d. Installation requirements
e. Power requirements
f. Maintenance and disinfection

13. Dialysis Unit design

a. Space between machines and bed
b. Area requirement
c. Isolation area
d. Planning and design for water distribution line
e. Gas lines requirements
f. Power requirements
g. Reuse area planning and requirements
h. Acid and bicarbonate mixing area
i. Storage
j. Biomedical Waste Management
k. ISN guidelines regarding unit design

14. **Reverse osmosis system**

a. Types of Medical RO

- Installation requirements
- Power requirements: Single-phase and three-phase, Voltage and ampere
- Water pressure: Minimum requirements and unit of measurement
- Water Flow: Flow measures, Minimum requirements, unit of measurement • Pre-treatment systems
  - ✞ Multimedia Depth filter: Monitoring, Backwash and troubleshooting
  - ✞ Softener: Monitoring, Regeneration and Troubleshooting

- ✞ Carbon Bed: Monitoring, Backwash and troubleshooting ✞
  Cartridge filters: Monitoring and troubleshooting

- RO water Distribution line
- Drain lines
- Disinfections and maintenance of RO
- Hot disinfection
- Basic setting and Monitoring of the system
- Flow diagrams
- Ultraviolet light
- Post-treatment systems- DI/DM and ultrafilters, advantage and disadvantage

b. Portable RO

- ✦ Installation requirements
- ✦ Power requirements
- ✦ Water pressure and quality requirements
- ✦ Feed Water Flow requirements
- ✦ Pre-treatment systems incorporated in Portable RO
- ✦ Drain lines
- ✦ Disinfections of RO and distribution loops
- ✦ Basic setting and Monitoring of the system
- ✦ Flow diagrams

c. Checking water quality

- Chlorine- Frequency, AAMI recommendation, the allowable range
- Hardness- Frequency, AAMI recommendation, the allowable range
- pH - Frequency, AAMI recommendation, the allowable range • TDS- Frequency, AAMI recommendation, the allowable range
- Chemical analysis – Frequency, AAMI recommendation, the allowable range.
- Bacteriology - AAMI recommendation, frequency and sample collection
- Endotoxin- AAMI recommendation, frequency and sample collection

15. Equipment Preventive maintenance and service
16. Difference between Annual Maintenance Contract (AMC) and Comprehensive Maintenance Contract (CMC).
17. Association for Advancement of medical instrumentation (AAMI) guidelines related to Dialysis Instruments.

PRACTICAL – Paper 2: Biomedical instrumentation: Dialysis equipment

1. Haemodialysis machine checking – dialysate Flow, conductivity, blood leakage detector and air bubble detector
2. Haemodialysis machine arterial pressure and venous pressure checking

3. APD machines basic settings
4. Water treatment system- Cleaning, disinfection, Monitoring and troubleshooting
5. Different types of disinfection modes for haemodialysis machines and usage
6. Dialyser Reprocessor- cell calibration and chemical cleaning and sanitization
7. Distribution loop designing
8. Volumetric ultra-filtration; Flow equalizer / balancing chamber
9. Explain dialysate circuit
10. Endotoxin filters change in HD machines
11. Checking water quality- Chlorine, Hardness, pH and TDS
12. Basic Haemodialysis machines troubleshooting
13. Preventive maintenance – Haemodialysis Machines, Reprocessors, CRRT machines, Water treatment system
14. Safety check – Defibrillator, BP apparatus, Cardiac monitors, weighing scale

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Biomedical instrumentation and Dialysis equipment** shall be as given under

SUBJECTS HAVING MAXIMUM MARKS- 100 marks			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			100

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

SCHEME OF EXAMINATION – PRACTICAL

The scheme of examination for " **Biomedical instrumentation: Understanding basic functions of Dialysis equipment**" Practical shall be as follows:

Distribution of marks

Type of questions	**Marks allotted**
Spotters	40
Practical	50
Viva	40
Record	10
IA	20
Total	**160**

Distribution of Marks for University Theory and Practical Exam

Theory			**Practical**				**Total**
Theory	IA	Total	Practical	IA	Viva Voce	Total	
100	**20**	**120**	**100**	**20**	**40**	**160**	**280**

Reference:

1. INTRODUCTION TO BIOMEDICAL INSTRUMENTATION: MANDEEP SINGH
2. Biomedical Instrumentation Systems: Shakti Chatterjee, Aubert Miller – 2012
3. Manufactures service manual and operator's manual
4. AAMI guidelines
5. Handbook of Dialysis -5th Edition

Paper 3: ADVANCEMENTS IN EXTRACORPOREAL THERAPIES

1. **Paediatric Haemodialysis**

a. Paediatric Haemodialysis

- Introduction,
- HD in ARF causes of ARF in children,
- Indication for Dialysis, principles of Dialysis in ARF
- Technical aspects of pediatric HD
- Vascular access
- Complications of vascular access

b. Pediatric Peritoneal Dialysis

- 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,
- Complications of PD

c. Pediatric CRRT and online haemodiafiltration:

- Pediatric operational principles of CRRT,
- characteristics of available hemofilter
- practical operational details,
- clinical experience in the neonate, clinical experience in older children,
- conclusion.

d. Nutritional Management of Pediatric patients on chronic Dialysis

e. Psychosocial problems related to Dialysis in pediatric patients:

f. Management of common Electrolyte Disorders in children

g. Clinical Considerations in the Evaluation of Dialysis Patients

2. **Treatment of poisoning with Extracorporeal method and drug overdose**

a. Initial Management

b. Gastrointestinal Manipulation

c. Altering Urinary pH

d. Criteria for Consideration of Dialysis or Hemoperfusion in Poisoning

e. Choice of therapy

- Peritoneal Dialysis
- Haemodialysis
- Haemoperfusion

- Continuous Haemodiafiltration or haemoperfusion.

f. Technical requirements
g. Complications
h. Examples of a few drugs that can be removed by Dialysis and haemoperfusion
i. Hemoperfusion and Hemodialysis with Chelation
j. Recent studies related to Extracorporeal treatment for poison

4. Online Haemodiafiltration (HDF) and recent studies relevant to HDF

a. CONVECTION-BASED CLEARANCES
b. Clearance due to diffusion and convection in HDF
c. Formulas for Solute Clearance with Hemodiafiltration
d. Advantages and Shortcomings of Each of HDF Modalities
e. Technical issues for online HDF
f. HDF – clinical benefits
g. Issues to be considered when applying convective modalities
h. Alternative convective methods

5. Home and intensive dialysis

a. Modality selection.
b. Home HD
    - Patient selection.
    - Home environment suitability.
c. Technical considerations for home HD
    - Training.
    - Vascular access.
    - Dialysis membranes.
    - Patient safety and precautions.
    - Alarms and communication.
    - Prevention of line disconnection
    - Prevention of morbidity when lines disconnect
        - Closed connector devices
        - Moisture detectors
        - Two-pump, single-needle system
        - Two-pump, single-needle system
d. Infrastructure requirements for home HD • Support staff
    - Space.
    - Water supply.
    - Water purification(Portable RO)
    - Dialysis machines.
    - Remote overnight Monitoring.
    - Prescription of intensive HD

e. Physiological rationale
    - Solute removal advantage of increased weekly dialysis time.
    - Solute removal advantage of increased frequency.
    - Ultrafiltration advantage of increasing weekly dialysis time.
    - Ultrafiltration advantage of increasing dialysis frequency
    - The benefit of avoiding a long interdialytic interval
    - Potential adverse effect of frequent, long nocturnal haemodialysis schedules on residual kidney function
    - Adequacy and urea clearance

f. Prescription recommendations for urea clearance
    - DHD
    - NHD

g. Dialysate composition.

h. Bicarbonate

i. Phosphorus.

j. Calcium

k. Anticoagulation.

l. Ultrafiltration, adjustment of target weight, and antihypertensive medications m. Follow-up
    - Clinic visits
    - Blood tests.

n. Comparative effectiveness and safety of home and intensive HD versus other Modalities
    - Conventional home HD
    - Frequent HD

o. Short and standard frequent HD.
    - Long, frequent HD
    - Long-session Dialysis given three times per week or every other day

6. Continuous renal replacement therapy (CRRT)

a. Treatment modes

b. Comparison

c. Effluent dose and its calculation

d. Filtration fraction: calculations

e. Predilution and post-dilution

f. CRRT fluids and content

g. Preparation and modification of CRRT fluids

h. Technical aspects of CRRT

i. Prescribing and delivering CRRT

j. Dose versus outcome

k. Empiric dosing

l. Dosing for SLED and SLED-F

m. Six steps to estimating the prescription

n. Anticoagulation
o. Regional citrate anticoagulation.
p. Swartz protocol
q. Signs of filter clotting
r. Vitamins and minerals
s. Principles of drug removal by CRRT
t. Isolated ultrafiltration
    - SCUF
u. SLED and SLED-F

CRRT pointers for certain groups of patients

v. Brain oedema
w. Sepsis and multiorgan failure
x. Acute lung injury and acute respiratory distress syndrome (ARDS)
y. Prevention of radiocontrast-induced nephropathy.
z. Intoxication with dialyzable or filter-permeable drugs or toxins aa. Extracorporeal membrane oxygenation (ECMO)
    - CRRT connections in ECMO
    - Challenges in CRRT connection to ECMO bb. recent studies relevant to CRRT

7. Liver replacement therapies

a. Molecular Adsorbent Recirculating System (MARS) and recent studies relevant to MARS
b. Adsorption cartridges used in acute liver failure
c. Priming and setup in liver replacement therapies

8. Sorbet dialysis technology and recent development

9. Therapeutic plasma exchange

a. Therapeutic plasma exchange
    - RATIONALE FOR PLASMAPHERESIS (TPE).
    - A. Principles of treatment
        - Use of concomitant immunosuppression.
        - Early treatment
    - PHARMACOKINETICS OF IMMUNOGLOBULIN (IG) REMOVAL
        - Plasma half-life.
        - Extravascular distribution and equilibration rate ○ The macromolecule reduction ratio and *Ve*/*V*p.
        - Reaccumulation.
        - Pharmacokinetic basis for TPE prescriptions. ○ Estimation of plasma volume.

b. TECHNICAL CONSIDERATIONS
    - Centrifugal apheresis.
    - Membrane plasma separation (MPS)
    - Comparison of membrane and centrifugation devices

c. Vascular Access

d. Anticoagulation
e. Replacement Solution
f. Complications
g. INDICATIONS FOR PLASMAPHERESIS.
    - Anti-GBM disease
    - TTP and HUS
    - Cryoglobulinemia
    - Antineutrophil cytoplasmic antibody (ANCA)–associated vasculitis
    - Multiple myeloma
    - Systemic lupus erythematosus
    - Recurrent focal segmental glomerulosclerosis (FSGS)
    - Henoch–Schönlein purpura (HSP) and IgA nephropathy
    - Hyperviscosity syndrome
    - Renal transplantation
    - Poisoning and drug overdose
h. New development in therapeutic plasma exchanges like • Double Filtration Plasmapheresis,
    - LDL apheresis.
    - Immunoadsorption columns.
    - Cryofiltration
    - Extracorporeal photopheresis
    - STEM CELL TRANSPLANTATION AND OTHER CELL THERAPIES

10. Peritoneal Dialysis

- Recent advancements
- Peritoneal Dialysis treatment modalities
- Peritoneal Dialysis Catheters, Placement, and Care
- Adequacy of Peritoneal Dialysis and Chronic Peritoneal Dialysis Prescription
- Patient training
- Management of peritoneal dialysis complications (Peritonitis, UFF, Metabolic and Mechanical complications)

11. Haemodialysis

- Recent advancement in haemodialysis treatment modalities
- Management of dialysis complications
- Management for Vascular access and its complications
- Anticoagulation
- Dialyser Reuse
- Adequacy of Haemodialysis

12. Clinical Practice Guidelines For Chronic Kidney Disease: Evaluation, Classification and Stratification

PRACTICAL – Paper 3: Advancements in Extracorporeal Therapies

- Patient assessment for Kidney transplantation
- Planning home dialysis and patient training
- CRRT –Treatment planning, Priming and starting treatment
- Plasmapheresis-Treatment planning, Priming and starting the treatment
- BCLS/ACLS demonstration.
- RO water treatment system, Monitoring and maintenance
- Sample collection for water culture, endotoxin and chemical analysis
- RO plant disinfection.
- Pediatric dialysis settings -Pediatric Hemodialysis, Peritoneal Dialysis, CRRT and plasmapheresis • Online HDF- Preparation and Treatment settings
- Advanced options – BVM, BTM and Single-needle Haemodialysis
- Hemoperfusion- Priming and starting treatment
- APD Machine settings
- Sample collections for Peritonitis.

Reference Books:

1. Handbook of Dialysis – 5th Edition – John T Daugirdass
2. Handbook of dialysis therapy – Allen R Nissenson 3. Core curriculum for dialysis technician- ANNA
4. KDOQI guidelines.
5. Journals: American Journal of Kidney disease
6. Journals: Nephrology Dialysis Transplantation

Scheme of Examination- Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Advancements in Extracorporeal Therapies** shall be as given under

SUBJECTS HAVING MAXIMUM MARKS- 100 marks			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50
Short answer	12 (attempt 10)	10 x 3	30

GRAND TOTAL			**100**

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

SCHEME OF EXAMINATION – PRACTICAL

The scheme of examination for **Advanced renal replacement therapies** Practical shall be as follows:

Distribution of marks

Type of questions	Marks allotted
Spotters	40
Practical	50
Viva	40
Record	10
IA	20
Total	**160**

Distribution of Marks for University Theory and Practical Exam

Theory			**Practical**				**Total**
Theory	IA	Total	Practical	IA	Viva voce	Total	
100	**20**	**120**	**100**	**20**	**40**	**160**	**280**

Paper 4: RENAL TRANSPLANTATION- BASIC CONCEPTS

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
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 –
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 a. 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
    a. /Age/Diabetes mellitus/Cardiovascular disease/ infections/Malignant neoplasms / metabolic bone
    b. disease GI disease/ pulmonary/ urologic evaluation/ systemic disease /psychiatric problems/ c. vascular disease.
    d. Social /Legal aspects
    e. Obtaining clearance for Transplant- Committee, legal documentation
    f. Government organizationS related to Organ Transplant
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 a. 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

b. management/ potential complications.

18. Immunosuppressive therapy – Induction protocols/ maintenance protocols

a. AZA/ Steroids/ CSA – Pharmacology – drug interactions

Reference book

1. Handbook of Kidney Transplantation- Gabriel M. Danovitch

2. Transplantation of human organ and tissues rules 2014

3. Kidney Transplantation - Principles and Practice: Stuart J. Knechtle, Peter J Morris · 2013

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for **Renal transplantation – Basic Concepts** shall be as given under

SUBJECTS HAVING MAXIMUM MARKS- 100 marks			
Type of questions	**Number of questions**	**Marks**	**Subtotal**
Long Essay	03 (attempt 2)	2 x 10	20
Short Essay	12 (attempt 10)	10 x 5	50
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			100

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100 marks

Distribution of Marks for University Theory and Practical Exam

Theory			**Practical**			**Total**
Theory	IA	Total	Practicals	IA	Total	
100	**20**	**120**	**-**	**-**	**-**	**120**

Subsidiary subjects – Second year MSc RDT

Subsidiary Subjects -Paper 1: Emergency Medicine / 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
    c. IV fluids-diagnose and correct the underlying cause of the arrest-internal cardiac compressioninitiation and discontinuation of resuscitation
    d. Specific Arrest Sequences in Advanced Cardiac Life Support: VF and Pulseless VT – Systole-Bradycardia-Pulseless electrical activity(PEA)-Tachycardias
    e. Post resuscitation Management
    f. Common Medications Used in Advanced Cardiac Life Support: Epinephrine-Atropine sulfateLidocaine-Procainamide hydrochloride-Bretylium tosylate-magnesium sulfate-adenosineDiltiazem 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

Reference Book:

1. Advanced Cardiac Life Support (ACLS) Provider Handbook - Karl Disque 2. Oxford Textbook of Critical Care- Andrew Webb

Scheme of Examination

Written (Theory): Maximum Marks: –100 marks.

No Practical or Viva-voce examination

**This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35 marks

Subsidiary Subjects -Paper 2: Hospital management & Quality in a healthcare

A. Management of Healthcare Organizations

1. **Management functions**
   a. Planning
   b. Decision making
   c. Organizing
   d. Staffing
   e. Controlling

2. **Management and Economics**
   a. Demand & Supply
   b. Nature of Costs
   c. Marginal cost and breakeven analysis
   d. Market structure: Business & Government
   e. Role of Government

3. **Organizational Behavior**
   a. Significance
   b. Structure & theories
   c. Individual & group behaviour
   d. Leadership
   e. Motivation
   f. Organizational development
   g. Managing creativity and stress

4. Accounting for Hospital Management

a. Budgeting & Budgetary control
b. Difference between forecast & budgeting_ Preparation of budget
c. Classification of budget
d. Capital Budgeting

B. Concept of Hospital

5. Hospital Structure

- Departments in Hospital
- Clinical services management
- Intensive care units
- Organizing of support services
- Management of utility services
- Evaluation of Hospital services
- Issues related to Healthcare technology
- Present trend in healthcare technology
- Problems & constraints
- Resource management (personnel, material & finance)
- Planning & adopting appropriate technology in healthcare
- Evaluation method of health technology

6. Emerging Concepts in HRM

- Leadership and Learning Organization
- Organization Culture and Change
- Code of Conduct
- Relationship
- Values and Work Ethics
- Staff Communication
- Succession Planning
- Health Issues and Repatriation
- Occupational Hazards: Health and Safety
- Welfare Programmes and Counseling

7. Operations and management of dialysis unit

8. Material Management

- Importance of material management
- Principles of material management, material forecasting
- Inventory management and analysis
- Import formalities relating to Medical Equipments
- Letter of credit, service contracts.
- Purchase style, need assessment

C. Total Quality Management

9. Total Quality Management

- Quality mission,
- Policy and objectives; concepts, evolution and determinants of quality;
- Interpretation and process of quality audits;
- Cost of quality and economics of quality. concepts of quality improvement,
- Quality assurance
- Quality assurance methods
- Patient satisfaction
- Standard operating procedure
- Quality certification & Accreditation
- Definition and underlying concepts
- Implementation and measurement of TQM
- Internal customer-supplier relationship, quality circles
- Quality improvement teams
- Teamwork and motivation in TQM implementation
- Training and education
- Role of communication in implementing TQM
- Policy deployment.
- Facets of quality
- quality planning
- quality improvement methods
- Kaizen
- quality audits
- Medical audit, accreditation,
- nursing care standards, Six Sigma
- Documentation of quality systems
- quality manual, procedure manuals
- work instruction manuals
- Current trends in TQ
- M- quality in healthcare, accreditation -with particular emphasis on NABH and ISO accreditation
- Dialysis quality indicators
- Clinical audit in Dialysis

Reference books:

1. Introduction to Health Care Management: Sharon B. Buchbinder, Nancy H. Shanks
2. Handbook of Healthcare Management: Donna M. Malvey, Myron Fottler, Donna Jean Slovensky
3. Return on Investment for Healthcare Quality Improvement: Craig A. Solid
4. Handbook Of Healthcare Quality & Patient Safety; Gyani J Girdhar

5. NABH Hospital Standards.
6. Joint Commission International (JCI) Accreditation Standards for Hospitals.
7. TOTAL QUALITY MANAGEMENT-P. N. MUKHERJEE
8. Quality in Health Care Sector – ASQC Quality Press.
9. Quality Improvement in Health Care,2nd Ed, Nelson Thrones
10. Total Quality Management, S. K. Joshy

Scheme of Examination

Written (Theory): Maximum Marks: –100 marks.

No Practical or Viva-voce examination

**This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35 marks

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 the record.

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