YENEPOYA

(DEEMED TO BE UNIVERSITY)
Recognized under Sec 3(A) of the UGC Act 1956
Accredited by NAAC with 'A' Grade

# YENEPOYA (DEEMED TO BE UNIVERSITY)

## Deralakatte, Mangaluru -575018

## REGULATIONS AND CURRICULUM GOVERNING

## POSTGRADUATE PROGRAM

## MASTER OF SCIENCE RENAL DIALYSIS TECHNOLOGY

**(CURRICULUM - EFFECTIVE FROM 2020-21)**

ATTESTED

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Ref: No. Y/REG/ACA/39-ACM/2020

09.09.2020

**NOTIFICATION**

Sub: Starting of new Programs under the Faculty of Allied and Healthcare Professions and approval the Curricula & Regulations – Reg:-

Ref: Minutes of the 39th Academic council meeting held on 27.08.2020, vide agenda - 16

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The Academic Council at its 39th meeting held on 27.08.2020 and subsequently the Board of Management at its 50th meeting held on 28.08.2020 have resolved to approve the proposal to start the following postgraduate programs (Choice Based Credit System) under the Faculty of Allied and Healthcare Professions.

1. M.Sc. in Renal Dialysis technology
2. M.Sc. in Medical Imaging technology
3. M.Sc. in Anaesthesia and OT Technology

The curricula and regulations for the above programs have been approved and these shall be effective from the academic year 2020-21 admission onwards.

**REGISTRAR**

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Copy to:

1. PA to Vice-Chancellor
2. Controller of Examinations
3. Dean, Allied and Healthcare Professions
4. Program coordinators
5. File copy

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**Yenepoya (Deemed to be) University**
**Regulations & programme curriculum**
**M.Sc. Renal Dialysis Technology under Choice Based Credit System.**

## 1. Preamble

Health care sector has become one of the largest employment generation sectors in India and abroad. Rapidly changing and expanding horizon of the health care sector demands formal training programs in all its Allied areas. Postgraduate Program in Allied Health sciences speciality often encompasses a wide range of disciplines. The learning during postgraduation is usually heavily research focused. Professionals in the medical field rely heavily on modern technology to successfully treat, diagnose, and care for patients. By doing postgraduation in Allied health disciplines one will be preparing for a career as an educator, researcher, or technologist. Students may find a variety of options upon completion of post graduation such as managing the Laboratories, Operation theatres, Radiology suites and Dialysis units. They can also join as teachers in the faculty of Allied and health professionals. They can also do research, pursue doctorate in their field of interest. They can also join biomedical equipment manufacturing company and pharmaceutical company as experts in their field.

The postgraduation in Renal Dialysis Technology will prepare the candidate for a career as an educator, researcher, or Therapist. Students may find a variety of options upon completion of post-graduation such as clinical instructor for dialysis therapist. Academic and Research pursuit are other areas that offer opportunities for professional growth and development. The Scope of growth in the field is tremendous with the improving healthcare system with an increase in Dailysis Care Facilities.

In accordance with this to match our education system with the international educational pattern we are introducing Choice Based Credit System from the academic year 2021 onwards.

## 2. Programme Objective:

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:

**PO 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.

**PO 2:** Have a good working knowledge of modern methods for scientific and clinical investigation of the human excretory system.

**PO 3:** Be aware of the major recent developments in research in the area of clinical dialysis therapy.

**PO 4:** Be able to embark upon a successful career in their chosen direction of advanced nephro- research**.**

**Expected skill to be acquired by the end of the programme:**

**PO 5:** Supervises the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts, including planning and scheduling.

**PO 6:** Providing expert support within the unit in the handling of all hemodialysis and peritoneal dialysis related and patient related issues, e.g. dialysis complications, dietary consultations, psychological care and vascular access issues in coordination with the nephrologists.

**PO 7:** Monitoring the dialysis patients for intra dialytic complications.

**PO 8:** Guiding and teaching the students about pediatric dialysis.

**PO 9:** Guiding the staff and students on dialysis unit policies, infection control and quality control standards as per unit polices.

**PO 10:** Quality maintenance and overall supervision of special procedures performed by the unit e.g. CRRT, ICU dialysis, pediatric dialysis, plasmapheresis, hemoperfusion, SCUF, and MARS.

**PO 11:** Supervising the conduct of regular ongoing patient education nutritional counseling programs in the dialysis unit.

**PO 12:** Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.

**3. Durations of the Programme:**

The duration of the programme shall extend over 4 semesters (2 academic years) of 15 weeks or more each with a minimum of 90 actual working days of instructions in each semester and 2 – 3 weeks of examinations. The successful completion will lead to Masters degree in Renal Dialysis Technology.

**4. Semester:**

An academic year shall consist of two semesters;

| | |
|---|---|
| Odd Semester 1st& 3rd | July/August to December/January |
| Even semester 2nd& 4th | January/February to June/July |

**5. Medium of Instructions:**

The medium of instruction and examination shall be English.

**6. Eligibility for admission:**

Candidates who have passed B.Sc. Renal Dialysis Technology (RDT) or B.Sc. Dialysis Therapy Technology (DTT) or B.Sc. Renal Replacement Therapy & Dialysis Technology (RRT&DT) degree from institutions where the mode of study is a full time program, with minimum 4 years duration from this university or any other university in India or abroad as equivalent with not less than 50% of marks in aggregate and have completed 1 year of compulsory rotating internship in Colleges recognized by Yenepoya (Deemed to be University)- Karnataka are eligible.

Candidates completing B.Sc. Program through correspondence course are not eligible.

**7. Semester System and Choice Based Credit System:**

The semester system accelerates the teaching-learning process. The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a cafeteria

'type approach in which the students can take courses of their choice, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

**8. Definition of Key words:**

a. **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.

b. **Choice Based Credit System**: The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

c. **Course:** Usually referred to, as 'papers" is a component of a programme. The courses shall define learning objectives and learning outcomes. A course shall comprise lectures/ tutorials/ laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study etc. or a combination of some of these.

d. **Credits:** Credit defines the quantum of contents/syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus, normally in each of the courses, credits will be assigned on the basis of the number of lectures/tutorial laboratory work and other forms of learning required, to complete the course contents in a 16-20 week schedule: One credit =1 hour of lecture per week/ two hours of Laboratory or practical/three hours of clinical rotation, field work/posting. All courses need not carry the same credits.

e. **Programs:** An educational program leading to award of a degree, diploma or certificate.

f. **Grade Point**: It is a numerical weight allotted to each letter grade on a 10-point scale.

g. **Credit Point**: It is the product of grade point and number of credits for a course.

h. **Cumulative Grade Point Average (CGPA**): It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

i. **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters: A+, A, B+, B, C, P, F.

j. **Semester Grade Point Average (SGPA):** It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered

in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

k. **Transcript or Grade Card or Certificate:** Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester.

l. **Semester System and Choice Based Credit System:** The semester system accelerates the teaching-learning process. The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a cafeteria 'type approach in which the students can take courses of their choice, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

## 9. Types of Courses

a. **Core course**: a course that should compulsorily be studied by a candidate as a core requirement is termed as a core course. This is the core requirement to complete the M.Sc. Renal Dialysis Technology programme.

b. **Open Elective**: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline or subject or domain or nurtures the candidates proficiency skill.

i. A candidate shall have the freedom to choose OE courses during the academic duration of the particular PG programme offered by Yenepoya (deemed to be) University through the PG departments or SWAYAM/MOOC external online platforms or a mix of courses offered by Yenepoya (deemed to be) University and SWAYAM/MOOC as appropriate.

ii. A candidate opting for SWAYAM/MOOC courses shall have the freedom to choose the courses of once own choice and complete such courses before appearing fourth Semester End Examination.

iii. A candidate shall compulsorily submit the pass certificate of each course successfully completed to the controller of examination of Yenepoya (deemed to be ) University

through the proper channel before appearing the fourth semester end examination.

iv. A candidate opting OE courses offered by the Yenepoya (deemed to be) University through the PG departments need to take up these courses generally during second and third semesters of the programme.

v. A candidate shall not take the courses offered by the department in which she/he is enrolled.

vi. Registration for the OE courses offered by the Yenepoya (deemed to be) University shall be at least one week prior to the commencement of the course with the CBCS coordinator. The CBCS unit shall notify the list of courses after being approved by the respective BOS. For SWAYAM/MOOC courses shall be as per the enrollment notification by the respective implementation authorities.

Yenepoya (deemed to be) University shall adapt the regulations of UGC governing SWAYAM/MOOC courses as amended from time to time.

**10. Assigning Credit Hours per Course**

While there is flexibility for the departments in allocation of credits to various courses offered, the general formula shall be:

a. Every Core course shall be restricted to a maximum of 4 credits.
b. Projects shall be restricted to a maximum of 25 credits.
c. Every Open Elective course offered by the Yenepoya (Deemed to be) University shall be restricted to a maximum of 3 credits.
d. A candidate shall compulsorily complete a minimum of Two Open Electives (Total Six Credits) during the PG programme.
e. These courses shall be selected either from the SWAYAM/MOOC courses notified by the UGC time to time or from the list of courses offered by the respective PG departments following CBCS pattern of the Yenepoya (Deemed to be) University.
f. Weightage of the credits with respect to SWAYAM/MOOC courses shall be 2 or 3 or 4 credits per course as per the course regulations of the implementing authorities. Accordingly, a candidate shall be permitted to take Two (2) or Three (3) courses with a combination of 3+3, 4+2 and 2+2+2 credits respectively to a total of 6 credits.
g. A candidate who is desirous to add more credits shall be permitted to do so during the

academic duration through SWAYAM/MOOC online platform. Extra credits earned by a candidate shall be included in the marks card on submission of course completion certificate. However, it shall not be considered for awarding the Grade in the PG programme.

h. The credits assigned to the course are indicated as L: T: P format. For example, for a 4-credit course format could be: 4:0:0 or 1:2:1 or 3:1:0 or 0:0:4 etc.

## 11. Assigning Total Credits for a Programme

The UGC, in its notification No.F.1-1/2015 (Sec.) dated 10/4/15 has provided a set of "Model curricula and syllabi for CBCS programmes. In conformation with this notification, at YENEPOYA (Deemed to be University), for PG programs with a study period of 4 semesters, the total credits assigned are minimum **90 credits** to a maximum of **110 credits**.

## 12. CBCS Programmes Coding System

The coding system shall be in the consonance with the system followed by the office of the controller of examination. Presently the following coding pattern is followed.

a. First two letters describe the faculty name followed by level of programme (UG – 01; PG – 02) and two letters represent the programme.

b. Course code shall have prefix denoting semester number followed by an alphabet of respective type of courses such as C = Core, E = Elective, OE = Open Elective, P = Practical followed by numbers denoting number of courses taught –

**1st SEM:** 1C1, 1C2, 1E1, 1E2, 1E2, 1P1, 1P2 etc.

**2nd SEM:** 2C1, 2C2, 2E1, 2E2, 2OE1, 2OE2, 2P1, 2P2 etc.

**3rd SEM:** 3C1, 3C2, 3E1, 3E2, 3OE1, 3OE2, 3P1, 3P2 etc.

**4th SEM:** 4C1, 4C2, 4E1, 4E2, 4P1, 4P2 etc.

## 13. Attendance:

a. Each course (theory, practical, clinical etc.) shall be treated as an independent unit for the purpose of attendance. Candidates having minimum 80% attendance in each of the Courses can only qualify to appear for the Semester End Examination. The Candidates with less than 80% of attendance shall be required to repeat that Course by attending the semester.

b. There shall be no provision for condonation of shortage of attendance.

c. For SWAYAM/MOOC/NPTEL it shall be as per the regulations governing the courses of implementing authority.

d. The HOD/Course Coordinator through the Dean of Faculties shall announce the names of the candidates who will not be eligible to take the Semester End- Examinations (SEE) in the various courses and send a copy of the same to the Controller of Examinations (COE) Office. Registrations of such candidates for those courses shall be treated as cancelled.

**14. Scheme of examination**

a. Evaluation of a course shall be done based on continuous internal assessment (CIA) mode followed by semester end university examination (SEE) for each course.

b. The components of CIA (Continuous Internal Assessment) may include sessional tests, Seminar/Journal Club/Review/Assignment /Microprojects/Social involvement and other activities as determined by the board of studies in the respective departments.

c. The marks for CIA shall be 40% and SEE shall be 60%.

d. Candidate should have secured 40% in IA to be eligible for SEE.

e. Minimum marks required to be pass per course shall be 50% in aggregate (in IA and SEE put together).

f. There shall be examinations at the end of each semester ordinarily during December/January for odd semesters and during June/July for even semesters

g. The SEE duration shall be three hours.

h. A candidate has to pass minimum of two Core courses of each semester to be eligible to be promoted to next semester. A candidate who has more than three pending Core courses will not be allowed to take the Final Semester exam.

**Internal assessment format (distribution of marks)**

| **Internal Assessment Components** | **Maximum Marks** |
|---|---|
| Average of two IA tests | 10 |
| Journal Club /Seminar | 10 |
| Assignments | 10 |
| Case studies | 10 |
| Log Book/Record | 10 |
| Presentation Skill | 10 |
| **Total Marks** | **60** |

## Question Paper Pattern

| SUBJECTS HAVING MAXIMUM MARKS = 90 | | | | Duration |
|---|---|---|---|---|
| **Type of question** | **Number of questions** | **Marks for each question** | **Total** | |
| LONG ESSAY TYPE | 03 | 10 | 30 | 180 minutes |
| SHORT ESSAY TYPE | 12 | 05 | 60 | |
| SHORT ANSWERS | - | - | - | |
| | | **Total** | **90** | |

**Practical examination**

| SI.NO | Components | Marks |
|---|---|---|
| 1 | Spotters | 20 |
| 2 | Case Scenario/Stations | 20 |
| 3 | Viva Voice | 20 |
| Total Marks | | 60 |

**PARTICULARS OF PRACTICAL, VIVA-VOCE & DISSERTATION**

- Practical examination will be aimed at examination of clinical skills and competence of the candidates for undertaking independent work as a specialist.
- Viva- Voce examination shall aim at assessing depth of knowledge, logical reasoning, confidence & oral communication skills.
- Special emphasis shall be given to dissertation work during the M.Sc. RDT 2nd Year examination.
- The marks of Viva-Voce examination shall be included in the clinical examination to calculate the percentage and declaration of results.
- OSCE/OSPE- shall have minimum of 5 stations.

## 15. Evaluation of Answer Scripts

### a. Evaluation of answer scripts

i. Each theory examination shall be evaluated by one internal and one external examiner. There shall be a third evaluation if the difference is more than 15%.

ii. Practical examination shall be jointly conducted and evaluated by one internal examiner and one external examiner.

### b. Evaluation of Dissertation

i. Dissertation shall be evaluated by 2 examiners, 1 external & 1 Internal from the panel of examiners approved by the board of studies and by the University.

ii. The criteria for the evaluation shall be as prescribed by the board of studies.

## 16. Classification of Successful candidates:

The results of successful candidates at the end of each semester shall be declared in terms of Grade Point Average (GPA) and Alpha-Sign Grade. The results at the end of the sixth semester shall be classified on the basis of the Cumulative Grade Point Average (CGPA) obtained in all the six semesters and the corresponding overall alpha sign grade.

### a. Letter Grades and Grade Points:

| Letter Grade | Grade Point | Range of Marks |
|---|---|---|
| O+ (Outstanding) | 10 | 90 – 100 |
| O (Excellent) | 9 | 80 – 89.99 |
| A+ (Very Good) | 8 | 70 – 79.99 |
| A (Good) | 7 | 60 – 69.99 |
| B+ (Average) | 6 | 55 – 59.99 |
| P (Pass) | 5 | 50 – 54.99 |
| F (Fail) | <5 | < 50 |

**b. Cumulative Grade Point Average (CGPA):**

The results at the end of the fourth semester shall be classified on the basis of CGPA obtained in the four semesters and the corresponding overall letter grade. The letter grade as described bellow shall be adopted.

| Letter Grade | CGPA Range |
|---|---|
| O+ (Outstanding) | 9.0 – 10.0 |
| O (Excellent) | 8.0 – 8.99 |
| A+ (Very Good) | 7.0 – 7.99 |
| A (Good) | 6.0 – 6.99 |
| B+ (Average) | 5.5 – 5.99 |
| P (Pass) | 5.0 – 5.49 |
| F (Fail) | < 5.0 |

**17. Minimum for a pass:**

a. A candidate shall be declared to have passed the UG program if he/she secures at least CGPA of 4.0 (Course Alpha-Sign Grade P) in the aggregate of both internal assessment and semester end examination marks.

b. The candidates who pass all the semester examinations in the first attempts in Three years are eligible for ranks provided they secure at least a CGPA of 8.0 (at least Alpha-Sign Grade A).

c. The results of the candidates who have passed the sixth semester examination but not passed the lower semester examinations shall be declared as NCL (Not Completed Lower semester examinations). Such candidates shall be eligible for the degree only after completion of all the lower semester examinations.

d. A candidate who passes the semester examinations in parts is eligible for only CGPA and Alpha-Sign Grade but not for ranking.

e. There shall be no minimum in respect of internal assessment and viva-voce marks.

f. A candidate who fails in any of the project work/project report/dissertation shall reappear for the same and pass the examination subsequently with in the nearest semester and examination schedule.

**18. Carry over provision:**

Carry over shall be allowed to the candidates for all the semesters.

**19. Re-Entry after Break of the study:**

a. Candidates admitted to a program abstaining for more than 3 months must seek readmission into the appropriate semester.

b. The candidate shall follow the syllabus in vogue (currently approved/is being followed) for the program.

c. All re-admissions of candidates are subject to the approval of the Vice Chancellor

**20. Maximum period for completion of the Programme**

A candidate shall complete the four semesters (two years) program within five years from the date of admission.

# SEMESTER I

## Course Title: Renal Anatomy & Physiology

**Number of Hours:** 60 **Total Credits:** 4

## Learning Objectives:

- To understand the anatomy and physiology of the renal system.
- To comprehend the histology of a human kidney.
- To understand the mechanism of formation of urine.
- To understand the renal regulation of blood volume and extracellular fluid volume.
- To comprehend acid base balance.

## Course Content:

**UNIT I: Basic anatomy of urinary system** 5 Hours

- Gross anatomy of kidney
- Embryology and fetal development in brief
- Anatomy of Peritoneum

**UNIT II: Histology of the kidney** 10 Hours

- T.S of a human kidney
- Photomicrograph of part of the renal cortex
- Photomicrograph of the blood supply to the kidney cortex
- Photomicrograph of the renal corpuscle
- Microscope of the visceral epithelium
- Microscope of a peripheral portion of a Renal corpuscle
- Electron microscope filtration barrier
- Diagram of a lobule of glomerular capillaries
- Juxta glomerular complex
- Renal cortex
- Renal cortex showing the proximal convoluted tubule and distal convoluted tubule
- Proximal convoluted tubule
- Renal medulla
- Renal papilla
- Distal convoluted tubule
- Collecting tubule

- Deep cortical area and outer medulla
- Kidney cortex the JG apparatus
- Kidney Medulla – papilla
- Papilla adjacent to a calyx, longitudinal
- TS of ureter
- Ureter wall TS
- Urinary bladder TS
- Urinary Bladder mucosa

**UNIT III: Kidney & Body Fluids** 10 Hours

- 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
- Formation of urine by the kidney: Renal Blood Flow, Glomerular filtration and their control.
- Physiologic anatomy of the kidney
- Basic theory of nephron function
- Renal blood flow and pressures
- Glomerular filtration and the glomerular filtrate
- Control of the glomerular filtration rate and renal blood flow
- Reabsorption of fluid by the peri-tubular capillaries
- Formation of urine by the kidney: Processing of the filtrate in the tubules
- Eeffect of tubular load and tubular transport maximum on urine constituents

- The concept of Plasma Clearance its use in assessing renal function
- 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
- 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
- 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
- Renal Disease, Diuresis, and Micturition
- Renal Disease
- Renal Function tests
- Diuretics and mechanisms of their actions
- Micturition

**UNIT IV: Physiology of Peritoneum** 10 Hours

- Diffusion through the peritoneum.
- Definition
- Factors influencing solute transport
- Peritoneal permeability
- Solute characteristics
- Concentration gradient
- Peritoneal blood flow
- Dialysis solution temperature
- Available membrane area
- Routes of solute transport.
- Intracellular.
- Extracellular.
- Factors that enhance diffusion.
- Increased dialysis solution flow.
- Increased blood flow.
- High concentration gradient.
- Pre-warmed dialysis solution.
- Osmotic pressure
- Osmosis through the peritoneal membrane.
- Ultrafiltration.
- Drug transport.

**UNIT V: Anatomy of vascular system related to hemodialysis** 10 Hours

- Upper limb vessels: Course, distribution, branches, origin, and abnormalities.
- Neck vessels: Course, distribution, branches, origin, and abnormalities.
- Femoral vessels: Course, distribution, branches, origin, and abnormalities

**Learning Outcomes:**

After completing this course you can be able to:

- Describe the Structural & Gross anatomy of Kidney.
- Describe the microscopic structure of the kidney.
- Explain Body Fluids.
- Describe the mechanism of urine formation.
- Explain renal autoregulation.
- Describe the physiology of peritoneum.

**Reference Books:**


1. Chaurasia BD. Human anatomy. CBS Publisher; 2004.
2. Skorecki K, Chertow GM, Marsden PA, Taal MW, Alan SL. Brenner & Rector's the kidney.Philadelphia, PA: Elsevier; 2016.
3. Waugh A, Ross GA. Wilson anatomy and physiology in health and illness.

## Course Title: Renal Pathology & Microbiology

**Number of Hours:** 60 **Total Credits:** 4

## Learning Objectives:

- To understand the pathology and microbiology of the renal system.
- To comprehend the congenital anomalies of a human kidney.
- To understand the pathogenesis of glomerular injury.
- To comprehend tumors of the kidney.
- To understand the infection control practices in dialysis unit.
- To comprehend opportunistic infections.

**Course Content:**

**Renal Pathology**

1. **UNIT I: Congenital Anomalies** 5 Hours

- Cystic Diseases of the kidney
- Cystic Renal Dysplasia
- Autosomal Dominant (Adult) Polycystic Kidney Disease
- Autosomal Recessive (Childhood) Polycystic Kidney Disease
- Cystic Diseases of Renal Medulla
- Medullary sponge kidney
- Nephronophthisis-Uremic Medullary Cystic Disease Complex
- Acquired (Dialysis –Associated) Cystic Disease
- Simple cysts

2. **UNIT II: Glomerular Diseases** 5 Hours

- Clinical manifestations
- Histologic alterations
- 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
- Rapidly Progressive (Crescentic) Glomerulonephritis
- Nephrotic Syndrome
- Membranous Glomerulonephritis (Membranous Nephropathy)
- Minimal Change Disease (Lipoid Nephrosis)
- Focal Segmental Glomerulosclerosis
- Membrano-proliferative Glomerulosclerosis
- IgA Nephropathy (Berger Disease)
- Focal Proliferative And Necrotizing Glomerulonephritis (Focal Glomerulonephritis)
- Hereditary Nephritis
- Alport syndrome
- Thin Membrane Disease (Benign familial Hematuria)

**3. UNIT III: Chronic Glomerulonephritis** 5 Hours

- Glomerular Lesions Associated with Systemic Disease
- Systemic Lupus Erythematosus
- Henoch-Schoenlein Purpura
- Bacterial Endocarditis
- Diabetic Glomerulosclerosis
- Amyloidosis
- Fibrillary and Immunotactoid Glomerulonephritis

- Other Systemic Disorders
- 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. **UNIT IV: Diseases of Blood Vessels** 5 Hours

- Benign Nephrosclerosis
- Malignant Hypertension And Accelerated Nephrosclerosis
- Renal Artery Stenosis
- Thrombotic Microangiopathies
- Classic (Childhood) Hemolytic-Uremic Syndrome
- Adult Hemolytic-Uremic Syndrome/Thrombotic Thrombocytopenic Purpura
- Other Vascular Disorders
- Atherosclerotic Ischemic Renal Diseases
- Sickle Cell Diseases Nephropathy
- Diffuse Cortical Necrosis
- Renal Infarcts

5. **UNIT V: Urinary Tract Obstruction (Obstructive Uropathy)** 2 Hours

6. **UNIT VI: Urolithiasis (Renal Calculi, Stones)** 3 Hours

**7. UNIT VII: Tumors Of The Kidney** 5 Hours

- Benign Tumors
- Renal Papillary Adenoma
- Renal Fibroma or Hematoma (Reno medullary Interstitial Cell Tumor)
- Angiomyolipoma
- Oncocytoma
- Malignant Tumors
- Renal Cell Carcinoma (Hypernephroma, Adenocarcinoma of Kidney) Classification of Renal Cell Carcinoma: Histology, Cytogenetics, and Genetics
- Urothelial Carcinomas of Renal Pelvis

**8. UNIT VIII: Microbiology** 10 Hours

- Microbiology of UTI.
- Hepatotrophic viruses in detail – mode of transfusion universal precautions, vaccinations.
- HIV- Mode of transfusion, universal precautions.
- Opportunistic infections.
- Microbiology of vascular access infection – Femoral, jugular, subclavian catheters. (Bacterial infection).
- Sampling methodologies for culture & sensitivity.
- Vancomycin resistant enterococci & other antimicrobial – resistant bacteria (Drug, resistant micro- organisms).
- Infections through contaminated HD equipment's or dialysate or errors in reprocessing.
- Non infections agents in HD pts
- Endotoxin
- Endotoxin A
- Other biological toxins
- Infection control precautions for Dialysis units
- Sterilization & Disinfection
- Sterilization and disinfection classification, principle, methods
- Central sterile supply department

## Learning Outcomes:

After completing this course you can be able to:

- Describe the Congenital anomalies.
- Describe the Glomerular diseases.
- Explain Urolithiasis.
- Define the urinary tract infection.
- Explain opportunistic infections.
- Describe the infection control practices in dialysis unit.

## Reference Books:


1. Fogo AB, Cohen AH, Colvin RB, Jennette JC, Alpers CE. Fundamentals of renal pathology. Berlin: Springer; 2014.
2. Fogo AB, Kashgarian M. Diagnostic Atlas of Renal Pathology E-Book. Elsevier Health Sciences; 2016 Sep 21.
3. Mohan H. TEXTBOOK OF PATHOLOGY, Harsh Mohan, 2010, JAYPEE BROTHERS MEDICAL PUBLISHERS (P) LTD. Jaypee brothers Medical Publishers (P) ltd; 2010.
4. Baveja CP. Textbook of microbiology. Arya Publications; 2005

## Course Title: Clinical Dialysis I

**Number of Hours: 300** **Total Credits: 10**

## Course Objectives:

- Monitoring the dialysis patients for intra dialytic complications.
- Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.
- Involve in the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts.

## Course Content:

In the Clinical Dialysis I the student will get experience in various aspects in dialysis unit under the supervision of experienced professionals and is expected to work and contribute in the dialysis unit.

## Course Title: Biomedical Research & Biostatistics

**Number of Hours: 30 Hours** **Total Credits: 2**

## Learning Objectives:

- To Understand the Statistical Terms.
- To Possess Knowledge and Skill in the use of Basic Statistical and Research Methodology.

## Course Content:

**Unit 1: Introduction** 8 hours

Introduction to biostatistics &research methodology, types of variables & scales of measurements, measure of central tendency & dispersion, rate, ratio, proportion, incidence & prevalence

**Unit 2: Sampling** **4** hours

Population & Sample, Sampling and non-sampling errors and methods of minimizing these errors, Random and non random sampling, different sampling techniques – simple random, stratified, systematic, cluster& multistage.

**Unit 3: Sampling distributions** 5 hours

Parameter and Statistic. Standard error. Basic probability distributions - Normal, poisson, binomial distributions with their applications in biological sciences.

**Unit 4: Tests of significance** 10 hours

Basics if testing of hypothesis – Null & Alternative hypothesis, type 1 and type II errors, level of significance (parametric) & power of the tests, p value, Confidence interval. Tests of significance – T test (paired & un paired), Chi square test & Test of proportion, One way analysis of variance. Repeated measures analysis of variance. Tests of significance (non parametric) – Mann – Whitney U Test, Wilcoxon Test, Kruskal – Wallis Analysis of variance, Friedmann's Analysis of variance

**Unit 5: Correlation and regression** 5 hours

Linear correlation by Karl Pearson and rank order correlation due to Spearman, Testing the significance of correlation co efficient, simple linear regression – estimation & testing, residual plots, multiple linear regression.

**Unit 6: Sample size determination** 2 hours

General concept. Sample size for estimating means and proportion, testing of difference in means and proportions of two groups.

**Unit 7: Study designs** 2 hours

Descriptive epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods – case control and cohort studies. Clinical trials / intervention studies, odds ratio and relative risk, stratified analysis

**Unit 8: Multivariate analysis** 5 hours

Concept of multivariate analysis, introduction to logistic regression and survival analysis

**Unit 9: Reliability and validity of diagnostic tests** 2 hours

Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), ROC curve.

**Unit 10: Format of scientific documentations** 2 hours

Structure of research protocols, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta-analysis.

## Reference Books:


1. Rao NSN : Applied statistics in health sciences, JP publishers.
2. Mahajan B.K: Methods of biostatistics, Kothari book depot, A.D Marg, Bombay.
3. Potti L.R : A text book of statistics, Yamuna publications, Sreekanteshwaram, Trivandrum.
4. Lancaster H.O: Introduction to medical statistics, Johnwiley & sons, New York.
5. Leius A.E : Biostatistics, Reinhold publishing Co, New York.
6. Cotton T : Statistics in medicine, Little Brown & Co, Boston.
7. Hill A.B : Principles of medical statistics, Oxford University press, New York.

## DISTRIBUTION OF TEACHING LEARNING ACTIVITIES

## SEMESTER I

| Type of Course | Course Title | Credits Distribution ( L, T, P per Week) | | | | Marks Distribution | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total Credits | Theory | | Practical | | |
| | | | | | | IA | SEE | IA | ESE | |
| Core | Renal Anatomy & Physiology | 3 | 1 | - | 4 | 60 | 90 | | | 150 |
| Core | Renal Pathology & Microbiology | 3 | 1 | - | 4 | 60 | 90 | | | 150 |
| Core | Clinical Dialysis I | | | 20 | 10 | | | 60 | 90 | 150 |
| Subsidiary | Biomedical Research and Biostatistics | 2 | | - | 2 | 10 | 40 | | | 50 |
| | Total | | | | 20 | | | | | 500 |

# SEMESTER II

# Course Title: Renal Pharmacology

## Number of Hours: 60 Total Credits: 4

## Learning Objectives:

- Understand the general pharmacological principle.
- To Possess Knowledge and Skill in the use of common medications used by patient with renal failure.
- Understand the use of hemodialysis solutions and chemicals.

## Course Content:

**UNIT I: General Pharmacological Principle** 5 Hours

- Definitions, routes of drug administration
- Pharmacokinetics
- Pharmacodynamics
- Adverse drug effects

**UNIT II: Medications commonly used by patient with renal failure** 10 Hours

- Antacids and phosphate binders
- Anti anemic drugs
- Anticoagulants
- Antihypertensives
- Antimicrobials
- Antipruritic
- Cardiovascular drugs
- Chelating agents
- Electrolytes
- Laxatives
- Local anesthetics
- Potassium ion exchange resin
- Thrombolytic agents
- Vitamins

**UNIT III: Pharmacology related to Renal disease, Hemodialysis and Peritoneal dialysis**

30 Hours

- IV fluid therapy with special emphasis in renal disease.
- Diuretics – Classification, actions, dosage, side effects & contraindications
- Antihypertensive – Classification, action, dosage, side effects & contraindications, special reference during dialysis, vasopressors
- Drugs used in hypotension.
- Drugs & Dialysis – Dose & duration of administration of drugs
- Dialysable drugs – Phenobarbitone, Lithium, Methanol etc
- Vit D & its analogues, phosphate binders, iron, folic acid & other vitamins of therapeutic value
- Erythropoietin in detail.
- Heparin including low molecular weight heparin
- Protamine sulphate.
- Glutaraldehyde, sodium hypochlorite, hydrogen peroxide role as disinfectants & adverse effects of residual particles applicable to glutaraldehyde
- Haemodialysis concentrates – composition & dilution (Acetate & bicarbonates)
- PD fluid in particular hypertonic solutions composition (Dextrose, icodextrin solutions)
- Potassium exchange resins with special emphasis on mode of administration.

## Learning Outcomes:

After completing this course you can be able to:

- Define the pharmacokinetics and pharmacodynamics of a drug.
- Describe the commonly used medications used in renal failure.
- Explain the IV fluid therapy in renal disease.
- Explain dose, duration and administration of drugs in dialysis patients.
- Define anticoagulants.
- Explain erythropoietin in detail.
- Explain the use of hemodialysis solutions and chemicals.

## Reference Books:


1. Bowman WC, Rand MJ. Textbook of pharmacology. Blackwell Scientific Publications.; 1980 Sep 20.
2. Tripathi KD. Essentials of medical pharmacology. JP Medical Ltd; 2013 Sep 30.
3. Whalen K. Lippincott illustrated reviews: pharmacology. Lippincott Williams & Wilkins; 2018 Aug 14.

## Course Title: Nephrology and Kidney Disease

**Number of Hours: 60** **Total Credits: 4**

## Learning Objectives:

- Understand the clinical syndromes of renal diseases.
- To Possess Knowledge on glomerular diseases.
- Understand the causes, consequences and management of End Stage Renal Disease.
- Understand the renal disorders caused by acid base electrolyte disorders.

## Course Content:

**UNIT I: Patient Assessment** 5 Hours

- Physical Diagnosis
- Urinalysis
- Measurement of Glomerular Filtration Rate
- Measurement of Urinary Protein
- Renal Imaging Techniques
- Renal Biopsy
- Indications for Dialysis
- Drug Therapy in Renal Disease

**UNIT II: Clinical Syndromes** 5 Hours

- Etiology, Pathophysiology, and Diagnosis of Acute Renal Failure
- Management of Acute Renal Failure
- Prerenal Azotemia
- Obstructive Uropathy
- Asymptomatic Proteinuria
- Asymptomatic Hematuria
- Acute Glomerulonephritis
- Rapidly progressive Glomerulonephritis
- Nephrotic Syndrome

- Nephrolithiasis
- Urinary Tract Infection
- Disorders of Tubular Function

**UNIT III: Primary Glomerular Disease** 5 Hours

- Minimal Change Disease
- Focal Segmental Glumerulosclerosis
- Membranous glomerulopathy
- IgA Nephropathy
- Membranoproliferative Glomerulonephritis

**UNIT IV: Secondary Glomerulonephritis** 5 Hours

- Diabetic Nephropathy
- Lupus nephritis
- Post infectious glomerulonephritis
- Hepatitis-Associated Glomerulonephritis
- HIV-Associated Renal Disorders

**UNIT V: Other parenchymal Renal Diseases** 5 Hours

- Renal Dysplasia
- Cystic Diseases of the Kidneys
- Other hereditary Renal diseases
- Reflux Nephropathy
- Renal Vasculitis
- Other Vascular Renal Disorders
- Sickle Cell Nephropathy
- Renal Disease due to dysproteinemias

**UNIT VI: End-Stage Renal Diseases Causes and Consequences** 5 Hours

- Epidemiology and outcomes of End-Stage Renal Disease
- Renal Osteodystrophy
- Uremic pericarditis
- Anemia Associated with Renal Failure

- Other manifestations of Uremia

**UNIT VII: End-Stage Renal Disease Management** 5 Hours

- Technical Aspects of Hemodialysis
- Hemodialysis: Assessing Adequacy
- Complications of Hemodialysis
- Technical Aspects of Peritoneal Dialysis
- Complications of Peritoneal Dialysis
- Renal Transplantation: Epidemiology and outcomes
- Renal Transplantation: Donor and Recipient Evaluation
- Renal Transplantation: Classification and consequences of Rejection
- Renal Transplantation: Immunosuppression
- Complications of Renal Transplantation

**UNIT VIII: Hypertension** 5 Hours

- Essential Hypertension
- Renal parenchymal hypertension
- Renovascular Hypertension
- Pheochromocytoma
- Other Causes of Secondary Hypertension
- Hypertensive Emergencies
- Childhood Hypertension

**UNIT IX: Acid-Base and Electrolyte Disorders** 5 Hours

- Metabolic Acidosis
- Metabolic Alkalosis
- Respiratory Acidosis
- Respiratory Alkalosis
- Hyponatremia and Hypernatremia
- Hypokalemia and Hyperkalemia
- Hypocalcemia and Hypercalcemia
- Phosphorus
- Magnesium

## Learning Outcomes:

After completing this course you can be able to:

- Describe the clinical syndromes of renal diseases.
- Describe the glomerular diseases.
- Explain the disorders of acid-base and electrolyte disorders.
- Define Hypertension in renal failure.

## Reference Books:


1. Gilbert S, Weiner DE. National Kidney Foundation Primer on Kidney Diseases E-Book. Elsevier Health Sciences; 2017 Sep 11.
2. Bomback AS, Bakris GL. Chronic kidney disease (CKD) and hypertension essentials. Jones & Bartlett Publishers; 2010 Jul 15.
3. Hansel DE, Kane CJ, Paner GP, Chang SS, editors. The kidney: a comprehensive guide to pathologic diagnosis and management. Springer; 2015 Dec 16.
4. Himmelfarb J, Sayegh MH. Chronic Kidney Disease, Dialysis, and Transplantation E-Book: A Companion to Brenner and Rector's The Kidney-Expert Consult: Online and Print. Elsevier Health Sciences; 2010 Oct 22.

## Course Title: Biomedical Instrumentation

**Number of Theory Hours: 45** **Total Credits: 4**
**Number of Practical Hours: 30**

## Learning Objectives:

- To gain basic knowledge on transducer principles.
- To understand the parameter measurement setups of dialysis machine.
- To make the student understand the functions of Dialysis machine.
- To provide basic ideas about dialysis machine alarms.

## Course Content:

**UNIT I: Basic Transducer principles** 3 Hours

- The transducer and transduction principles
- Active transducers
- Passive transducers
- Transducers for Biomedical applications

**UNIT II: Sources of Bioelectric potentials** 2 Hours

- Resting and action potentials
- Propagation of Action potentials
- The Bioelectric potentials

**UNIT III: Electrodes** 2 Hours

- Electrode theory
- Biopotential electrodes
- Biochemical transducers

**UNIT IV: The computer in Biomedical Instrumentation** 3 Hours

- The digital computer - Computer Hardware, Computer software
- Microprocessors - Types of microprocessors, Microprocessors in Biomedical Instrumentation- Calibration , Table lookup , Averaging , Formatting and printout
- Interfacing the computer and medical instrumentation and other equipment.- Digital

interfacing requirement , Analog-to-digital and Digital-to-Analog conversion

- Biomedical computer application - Data acquisition, storage and retrieval, data reduction and transformation, mathematical operation, pattern recognition, limit detection, statistical analysis of data, data presentation ,control function - Computer analysis of the ECG, the digital computer in the clinical chemistry laboratory, digital computerized in hemodialysis machine, other computer application

**UNIT V: Electrical safety of Medical Equipment.** 5 Hours

- Physiological effects of electrical current.
- Shock hazards from electrical equipment.
- Methods of accident prevention
- Grounding
- Double insulation
- Protection by low voltage
- Ground – fault circuit interrupter
- Isolation of patient – connected parts
- Isolated power distribution systems

**UNIT IV: Patient care and monitoring** 5 Hours

- The elements of intensive – care monitoring
- Patient monitoring displays
- Diagnosis, calibration and repairability of patient – monitoring equipment
- Other instrumentation for monitoring patients
- The organization of the hospital for patient care monitoring
- Defibrillator

**UNIT VII: Description of Machine Functions and Malfunction** 5 Hours

- Description of the T1Test
- Function description of the s
- Function description of the hydraulic unit

**UNIT VIII: Technical safety checks and maintenance** 5 Hours

- General notes

- Technical safety checks and maintenance procedures
- VDE test
- TSC and maintenance checklist
- Overview of the Dip switches
- Calibration mode
- Hydraulics
- Air detector

**UNIT IX: Setup Menu** 5 Hours

- Overview
- Main menu
- Calibration Program

**UNIT X: Circuit diagram and circuit description** 10 Hours

- Block diagram
- Ac diagram
- Block diagram of voltage supply,
- Block diagram of screen
- Connection layout diagram
- P.C.B. LP 450 level detector control (LD)
- P.C.B. LP 493 BLD
- P.C.B. LP 624 Control board
- P.C.B. LP 630 Mother board
- P.C.B. LP 631 CPU 1
- P.C.B. LP 632 CPU 2
- P.C.B. LP 633 Input board
- P.C.B. LP 634 output board
- P.C.B. LP 635 Display board
- P.C.B. LP 636 external connectors
- P.C.B. LP 638 Power supply
- P.C.B. LP 639 Power logic
- P.C.B. LP 643.3 Control board (Hep)

- P.C.B. LP 644.3 Display board (Hep)
- P.C.B. LP 645 position sensor membrane pump
- P.C.B. LP 647 Power logic A
- P.C.B. LP 649 Display board
- P.C.B. LP 742 Interference filter
- P.C.B. LP 743 power control 2
- P.C.B. LP 744 Power control 1
- P.C.B. LP 747 Distribution board
- P.C.B. LP 748 Display board (BP)
- P.C.B. LP 758 COMMCO – II
- P.C.B. LP 763 Multi interface boarddd.
- P.C.B. LP 922 Display board
- P.C.B. LP 923Traffic light
- P.C.B. LP 924 Display board

## Learning Outcomes:

After completing this course you can be able to:

- Explain the Sources of bioelectric potential
- Describe the machine function and malfunction
- Explain the medical safety of medical equipment

## Reference Books:


1. Bronzino JD. Biomedical Engineering Handbook 2. Springer Science & BusinessMedia; 2000 Feb 15.
2. Khandpur RS. Handbook of biomedical instrumentation. McGraw-Hill Education; 1987.
3. Webster JG, editor. Medical instrumentation: application and design. John Wiley & Sons; 2009 Feb 3.

## Course Title: Clinical Dialysis II

**Number of Hours: 300** **Total Credits: 10**

## Course Objectives:

- Monitoring the dialysis patients for intra dialytic complications.
- Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.
- Involve in the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts.

## Course Content:

In the Clinical Dialysis I the student will get experience in various aspects in dialysis unit under the supervision of experienced professionals and is expected to work and contribute in the dialysis unit.

## DISTRIBUTION OF TEACHING LEARNING ACTIVITIES

## SEMESTER II

| Course Code | Course Title | Credits Distribution ( L, T, P per Week) | | | | Marks Distribution | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total Credits | Theory | | Practical | | |
| | | | | | | IA | SEE | IA | ESE | |
| Core | Renal Pharmacology | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Nephrology and Kidney Disease | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Biomedical Instrumentation | 2 | | 2 | 3 | 60 | 90 | | | 150 |
| Core | Clinical dialysis II | | | 20 | 10 | | | 60 | 90 | 150 |
| | Open Elective (OE) | 3 | | | 3 | 40 | 60 | | | 100 |
| | Total | | | | 24 | | | | | 700 |

**List of Open Electives**

1. MHA - Hospital Information System
2. MSW - Human Relations and Communication
3. MPH - Project Management
4. MPT - Women's Health & Pregnancy
5. MSc Bioscience - Scientific Communication
6. MSc Biostatistics - Basic Data Analysis Techniques
7. M Library & Information Science - Scholarly Communication

# SEMESTER III

## Course Title: Complications of Dialysis & Dialysis Equipment

**Number of Hours: 60** **Total Credits: 4**

## Learning Objectives:

- Understand the complications of dialysis procedure.
- Understand the patient related complications and its management.
- Gain knowledge on treatment and management of complications in special condition.

## Course Content:

**UNIT I: Procedure related complications and their management** **10 Hours**

**1.1 Hemodialysis related:**

- Vascular access complications
- Complications related to water treatment plant
- Complications related to dialysis fluids
- Complications related to dialyzers
- Complications related to anticoagulation
- Complications related to adequacy
- Acute dialysis complications

**1.2 Peritoneal Dialysis related:**

- Complications related to peritoneal access
- Complications related peritoneum
- Complications related to adequacy
- Complications related to infection (Peritonitis)

**1.3 Continuous Renal Replacement Therapy**

- Complications related to anticoagulation
- Complications related to fluid management
- Complications related to solute removal

**UNIT II: Patient related complications and their management in dialysis (PD & HD) patients** **20 Hours**

- Cardiac diseases in dialysis patients
- Hematological problems
- Coagulation problems
- Bone diseases
- Acid – base disorders
- Infectious problems
- Immune disorders
- Nutritional complications (including CRRT)
- Endocrinal problems (adult & pediatric)
- Dermatological problems
- Hypertension
- Pulmonary problems
- Quality of life
- Neurological complications
- Psychiatric and psychosocial problems
- Gastrointestinal complications
- Ocular complications

**UNIT III: Special conditions** **15 Hours**

- Complications of hemoperfusion
- ICU renal replacement therapy related complications
- Complications related to pediatric dialysis (acute & chronic dialysis)
- Dialysis in seropositive patients
- Complications in diabetic patients
- Complications related plasmapheresis
- Aspect – impact related to dialysis

**Learning Outcomes:**

After completing this course you can be able to:

- Explain the hemodialysis related complications.
- Describe the complications related to peritoneal dialysis.
- Explain the complications of hemoperfusion.
- Describe dialysis in seropositive.
- Explain the complications of dialysis in diabetic patients.

**Reference Books:**


1. Nissenson AR, Fine RE. Handbook of Dialysis Therapy E-Book. Elsevier Health Sciences; 2016 Oct 24.
2. Levy J, Brown E, Lawrence A. Oxford handbook of dialysis. Oxford University Press; 2016 Feb 18.
3. Daugirdas JT, Blake PG, Ing TS. Handbook of dialysis. Lippincott Williams & Wilkins; 2012 Feb 20.
4. Drukker W, Parsons FM, Maher JF, editors. Replacement of renal function by dialysis: a textbook of dialysis. Springer Science & Business Media; 2012 Dec 6.

## Course Title: Nutrition & Quality Assurance in Dialysis

**Number of Hours: 60** **Total Credits: 4**

## Learning Objectives:

- Discuss the various aspects of nutrition, nutritional assessments and recommended dietaryallowance.
- To explore the basic knowledge of quality assurance in dialysis equipment.

## Course Content:

**Nutrition**

**Unit 1: Nutrition** **10 Hours**

- Energy (Calories)
- Protein
- Lipid (Fats& Cholesterol)
- Carbohydrates
- Thiamine vitamin B1, aneurine
- Riboflavin
- Vitamin B6 (pyridoxine, adermin)
- Nicotinic acid (Niacin, nicotinamide)
- Folic acid (folate, folacin, pteroylglutamic acid)
- Vitamin b12 (cobalamin)
- Pantothenic acid(filtrate factor)
- Choline, biotin
- Ascorbic acid (vitamin C)
- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K
- Bioflavonoid (vitamin P)

- Sodium
- Potassium
- Iron
- Calcium
- Phosphate
- Magnesium
- Manganese
- Iodine
- Copper
- Cobalt
- Chloride
- Fluoride
- trace elements
- Dietary Fibers
- Water

**Unit 2: Foods** **5 Hours**

- Wheat
- Rice
- Pulses
- Soya beans
- Maize
- Millets
- Milk
- Egg
- Meats
- Nuts & Dried Fruits
- Sweet foods & sweetening agents
- Fish
- Vegetables
- Fruits
- Spices

- Beverage
- Alcohol

**Unit 3: Clinical Dietetics** **5 Hours**

- Diet Prescription
- Peptic ulcer
- Flatulence
- Constipation
- Diarrhea& dysentery
- Malabsorption syndrome
- Inflammatory bowel disease
- Liver disease
- Jaundice
- Hepatic Coma
- Cirrhosis of liver
- Fatty liver
- Protein- Energy malnutrition
- Gallstone Diseases
- Anemic
- Under weight
- Obesity
- Diabetes mellitus
- Gout
- Kidney disease
- Renal failure
- Kidney stones
- Coronary Heart Diseases and atherosclerosis
- High BP
- Congestive cardiac failure
- Acid and alkaline foods
- Tube feeding
- Parenteral nutrition

- Pregnancy and lactation
- Diet for children
- Diet in old age
- Diet for athletes

**Unit 4: Principles of Nutritional Assessment** **10 Hours**

- Introduction
- Nutritional assessment system
- Methods used in nutritional assessment
- The design of nutritional assessment system
- Evaluation of nutritional assessment indices
    - Reference distribution
    - Reference limits
    - Cutoff points
- Food consumption of Individual
    - Methods
    - New development in measuring food consumption
    - Selecting an appropriate method
    - Summary
- Evaluation of nutrient intake data
    - Tables of recommended nutrient intakes
    - Evaluating Nutrient intakes of individuals
    - Evaluating the nutrient intakes of population groups
    - Probability approach to evaluating nutrient intakes
- Anthropometric assessment
    - Advantages and limitations of anthropometric assessment
    - Sources of error in nutritional anthropometry
    - Evaluation of anthropometric indices
- Anthropometric assessment of growth
    - Growth measurement
    - Indices derived from growth measurements
- Anthropometric assessment of body composition
    - Assessment of body fat

    - Assessment of fat-free mass
- Laboratory assessment of body composition
    - Chemical analysis of cadavers
    - Total body potassium using 40 K
    - Total body water using isotope dilution
    - Other body fluid compartments using isotope dilution
    - Total body nitrogen
    - Densitometry
    - Other laboratory method for determining body composition
- Laboratory assessment
    - Static biochemical tests
    - Functional tests
    - Selection of laboratory tests
    - Evaluation of laboratory indices
- Assessment of protein status:
    - Assessment of somatic protein status
    - Assessment of visceral protein status
    - Metabolic changes as indices of protein status
    - Muscle function tests
    - Immunological tests
- Assessment of iron status
    - Hemoglobin
    - Hematocrit
    - Red cell indices
    - Serum iron, TIBC and transferring saturation
    - Serum ferritin
    - Erythrocyte protoporphyin
    - Multiparameter indices
- Assessment of status of thiamin, riboflavin and niacin
    - Assessment of thiamin status
    - Assessment of riboflavin status
    - Assessment of niacin status
- Assessment of the status of folate and vitamin B12

    - Assessment of folate status
    - Assessment of vitamin B12 status
- Assessment of the status of calcium, phosphorus and magnesium
    - Assessment of calcium status
    - Assessment of phosphorus status
    - Assessment of magnesium status
- Clinical assessment
    - Medical history
    - Physical examination
- Nutritional assessment of hospital patients
    - Methods based on single indices
    - Prognostic nutritional indices
    - Hospital prognostic indices
    - Cluster analysis
    - Subjective global assessment the prognostic value of nutritional assessmentindices

**Unit 5: QUALITY ASSURANCE** **20 Hours**

- Basics of quality assurance
- Quality assurance for water treatment plant
- Quality assurance for dialysis delivery system
- Quality assurance for dialysate and dialysate concentrate
- Quality assurance for dialyzers
- Ancillary devices and equipment-quality assurance
- Quality assurance for anticoagulation
- Quality assurance for vascular access devices
- Quality assurance for hemodialyzer reuse
- Infection control- Quality assurance
- Handling of toxic chemicals
- Medical device reporting

**Learning Outcomes:**

- Describe the various aspects of nutrition, nutritional assessments and recommended dietaryallowance.
- Elaborate quality assurance in dialysis equipment’s.

**Recommended Books:**


1. Mitch WE, Ikizler TA, editors. Handbook of Nutrition and the Kidney. Lippincott Williams & Wilkins; 2010.
2. Kopple JD, Massry SG, editors. Kopple and Massry's nutritional management of renal disease. Lippincott Williams & Wilkins; 2004.
3. Nissenson AR, Fine RE. Handbook of Dialysis Therapy E-Book. Elsevier Health Sciences; 2016 Oct 24.
4. Levy J, Brown E, Lawrence A. Oxford handbook of dialysis. Oxford University Press; 2016 Feb 18.
5. Daugirdas JT, Blake PG, Ing TS. Handbook of dialysis. Lippincott Williams & Wilkins; 2012 Feb 20.
6. Drukker W, Parsons FM, Maher JF, editors. Replacement of renal function by dialysis: a textbook of dialysis. Springer Science & Business Media; 2012 Dec 6.

## Course Title: Clinical Dialysis III

**Number of Hours: 300** **Total Credits: 10**

## Course Objectives:

- Monitoring the dialysis patients for intra dialytic complications.
- Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.
- Involve in the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts.

## Course Content:

In the Clinical Dialysis I the student will get experience in various aspects in dialysis unit under the supervision of experienced professionals and is expected to work and contribute in the dialysis unit.

## Course Title: Health Care Management

**Number of Hours: 30** **Total Credits: 2**

## Learning Objectives:

- Concepts of Hospitals – The student will gain knowledge about hospital administration & planning.
- Workflow in hospitals - Enumerate and identify various Clinical Services like OPD, IPD, ward Management, OT, Emergency, disaster Management and ICU.
- Organizational Structures - To learn to meet special challenges posed by human behavior in workplace of 21st century
- Quality management - To create an awareness about the process of applying for and implementing various accreditation process in healthcare facilities.

**Course Content:**

**Unit I: Hospital Structure** **2 hours**

- Introduction to Hospitals, Healthcare & Medical Care, Rationale of Hospital Administration
- History of Hospitals, Public Health Delivery system in India, Types of Hospitals, Voluntary Health Organizations

Unit II: **Management of Healthcare Organizations** **5 hours**

- Introduction to Management
- Evolution & Theories of Management
- Management Functions: Planning
- Organizing
- Controlling
- Decision Making
- Staffing
- Techniques in Management

Unit III: **Organizational Behavior** **5 hours**

- The Importance of Interpersonal Skills, Scope & Process of OB Structure & theories

- Motivation - Abraham Maslow's hierarchy of needs theory, Theory X & Y. Contemporary theories of motivation.
- Foundations of Group Behavior – Formal Vs Informal, Social Identity Theory
- Organizational Culture
- Communications in an Organization

**Unit IV: Management and Health Economics** **5 hours**

- Demand & Supply
- Nature of Costs
- Marginal cost and breakeven analysis
- Market structure: Business & Government, Role of Government

Unit V: **Accounting for Hospital Management** **5 hours**

- Budgeting & Budgetary control - Classification of budget, P & L, Balance Sheets
- Types of Accounts, Debit & Credit
- Financial Statement Analysis

Unit VI: **Concept of Hospital** **5 hours**

- Departmentation in Hospital
- Outpatient, Inpatient Services
- Intensive Care Unit, Emergency Services
- Laboratory, Radiology
- Organizing of support services, Utility Services
- Evaluation of Hospital services – Hospital Statistics
- Hospital Information Systems - Issues related to Healthcare technology, Planning, Infrastructure

Unit VII: **Evolution of Quality management** **3 hours**

- Quality Management Tools & methods
- Quality certification & Accreditation – NABH, NABL

**Text book/ Reference Books:**


1. Principles of Management by LM Prasad
2. Organizational Behaviour by Stephen Robbins
3. Hospital Planning & Administration by B.M. Sakharkar
4. Hospital Administration by CM Francis
5. Financial Management in Hospitals, Kulkarni, Satyashanker, Anil Gomes.

## SEMESTER III

| Course Code | Course Title | Credits Distribution ( L, T, P per Week) | | | | Marks Distribution | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total Credits | Theory | | Practical | | |
| | | | | | | IA | ESE | IA | ESE | |
| Core | Complications of Dialysis & Dialysis Equipment | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Nutrition & Quality Assurance in dialysis | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Clinical dialysis III | | | 20 | 10 | | | 60 | 90 | 150 |
| Core | Health Care Management | 2 | | | 2 | 10 | 40 | | | 50 |
| | Open Elective (OE) | 3 | | | 3 | 40 | 60 | | | 100 |
| | Total | | | | 20 | | | | | 500 |

**List of Open Electives**

1. MHA - Hospital Information System
2. MSW - Human Relations and Communication
3. MPH - Project Management
4. MPT - Women's Health & Pregnancy
5. MSc Bioscience - Scientific Communication
6. MSc Biostatistics - Basic Data Analysis Techniques
7. M Library & Information Science - Scholarly Communication

# SEMESTER IV

## Course Title: Recent Advances in Dialysis and Nephrology

**Number of Hours: 60** **Total Credits: 4**

## Learning Objectives:

- Discuss the clinical consideration and evaluation of renal diseases and dialysis patients.
- To explore knowledge on recent advances in dialysis therapy.
- Understanding pediatric dialysis

## Course Content:

**Unit 1: Pediatric Dialysis** **20 Hours**

- 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.

- 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.
- 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.
- Psychosocial problems related to dialysis in pediatric patients: Introduction, Adjustment, compliance, neuropsychological development, and rehabilitation.

- 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.
- 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.
- Management of common Electrolyte Disorders in children.
- Clinical Care Coordinator: The Pediatric Nephrology Technologist of the Future.

**Unit 2: Clinical considerations in the Evaluation of Dialysis Patients 10 Marks**

- Hypertension in Dialysis Patients
- Left Ventricular Dysfunction in Dialysis Subjects
- Coronary Artery Disease in End-Stage Renal Disease
- Autonomic Function and hemodynamic stability in End- Stage Renal Disease Patients
- Infection and immunity in End-stage Renal Disease
- B2-Microglobulin- Associated Amyloidosis of End-Stage Renal Disease
- Renal Osteodystrophy
- Dyslipidemias of End-Stage Renal Disease
- Selection of Therapy for Patients with End-stage Renal Disease
- Malnutrition and Intradialytic Parenteral Nutrition in ESRD Subjects
- Disorders of Hemostasis in Dialysis Patients
- Treatment of Anemia in Dialysis Subjects
- Acquired Cystic Kidney Disease
- Geriatric Dialysis Patients
- Diabetic Dialysis Patients
- Hemodialysis and Hemoperfusion for poisoning
- Dialysis considerations in the patient with Acute Renal Failure
- Infections in patients on Continuous Ambulatory Peritoneal Dialysis

- Balancing outcomes in Dialysis with Economic Realities

**Unit 3: Recent Advance in Dialysis and Nephrology** **10 Marks**

**Unit 4: Cyber Nephrology** **5 Marks**

## Learning Outcomes:

- Discuss the clinical consideration and evaluation of renal diseases and dialysis patients. To explore knowledge on recent advances in dialysis therapy.
- Define pediatric dialysis.

## Reference Books:


1. Nissenson AR, Fine RE. Handbook of Dialysis Therapy E-Book. Elsevier Health Sciences; 2016 Oct 24.
2. Sethi SK, Raina R, McCulloch M, Bunchman TE, editors. Critical Care Pediatric Nephrology and Dialysis: A Practical Handbook. Springer Singapore; 2019 Feb 1.
3. Deep A, Goldstein SL, editors. Critical Care Nephrology and Renal Replacement Therapy in Children. Springer; 2018 Aug 17.

## Course Title: Psychosocial Issues & Rehabilitation in dialysis patient

**Number of Hours: 60** **Total Credits: 4**

## Learning Objectives:

- Discuss the psychosocial issues, care and rehabilitation in dialysis patients.

**Course Content:**

**Unit 1: Psychosocial issues in renal failure** **10 Hours**

- Psychosocial issues in ESRD
- Psychiatric fitness for Transplantation

**Unit 2: Care and rehabilitation of dialysis patients** **20 Hours**

- CKD Management programs and patient education
- Approach to CKD patients for slowing progression of CKD and of cardiovascular disease
- General issues related to care of patients preparing for dialysis and chronic dialysis patients
- Quality life and rehabilitation in dialysis patients
- Quality of life in CKD- Management of CKD
- Conservative / palliative treatment and end of life care in CKD
- Pain management in CKD

**Unit 3: Nursing in renal disease** **10 Hours**

- Medical issues in dialysis
- Improving outcomes in dialysis patients
- Care of HIV dialysis patients
- Preparing CKD patient for dialysis- Management of CKD

**Unit 4: Physical activity and endurance exercise training in hemodialysis patients**

- Physical functioning definition and assessment
- Physical functioning in dialysis patients

- Physiotherapy in hemodialysis patients
- Ethical consideration in dialysis patients

## Learning Outcome:

- Discuss the psychosocial issues, care and rehabilitation in dialysis patients.

## Recommended Books:


1. Nissenson AR, Fine RE. Handbook of Dialysis Therapy E-Book. Elsevier Health Sciences; 2016 Oct 24.
2. Levy J, Brown E, Lawrence A. Oxford handbook of dialysis. Oxford University Press; 2016 Feb 18.
3. Daugirdas JT, Blake PG, Ing TS. Handbook of dialysis. Lippincott Williams & Wilkins; 2012 Feb 20.
4. Drukker W, Parsons FM, Maher JF, editors. Replacement of renal function by dialysis: a textbook of dialysis. Springer Science & Business Media; 2012 Dec 6.

## Course Title: Renal Transplantation

**Number of Hours: 60** **Total Credits: 4**

## Learning Objectives:

- To explore knowledge on renal transplantation Understanding transplant immunology

## Course Content:

Unit 1: History of Transplantation 2 hours

Unit 2: Characteristics of the allogenic immune response 2 Hours

Unit 3: Tolerance and immunity: 2 Hours

- Self – Non-self-discrimination
- Antigen recognition
- Immune tolerance

Unit 4: Transplantation antigens : 3 Hours

- ABO, Monocyte and Endothelial cells Ag
- Major + Minor Histocompatibility Ag

Unit 5: Major Histocompatibility Complex 3 Hours

- HLA GI and HLA GII
- Nature of Allorecognition
- Inheritance of HLA.

Unit 6: Tissue typing : 5 Hours

- HLA typing, Short term vs long term/ quality of typing
- Matching for split Ages, relative strengths of HLS cocci
- Effects of blood transfusion

Unit 7: Regulation of the Immune response – 5 Hours

- Role of Ag prescribing cell.
- T Cell receptor recognition of Ag
- CD4/CD8 cells subsets
- Accessory molecules
- T Cell activation
- T Cell energy
- Lymphokines and lymphokine receptors
- Th1 + Th2 cell subsets

Unit 8: Graft rejection 5 Hours

- Hyperacute / acute/ accelerated/chronic
- Mechanisms – Ab mediated/T cell mediated/ Delayed Type/ hypersensitivity – mediated NK cell mediated.
- Mechanisms of Immunosuppression – Corticosteroids/ Azathioprine/FK506/ Rapamycin/Polyclonal immuno Globulins/Mab
- Donor specific immune tolerance/ Tolerance induction by blockade of co stimulation
- Evaluation of the donor + recipient – special issued + consideration prior kidney Transplantation /Age/Diabetes mellitus/Cardiovascular disease/ infections/Malignant neoplasms / metabolic bone disease GI disease/ pulmonary/ urologic evaluation/ systemic disease /psychiatric problems/ vascular disease.
- Immunological evaluation of the Transplant recipient – typing + Ag matching
- Screening of Humoral sensitization

Unit 9: Cross matching – techniques 4 Hours

- ABO Blood group matching/ family testing to determine haplotypes/ Cellular assays for HLA testing/ Analysis of survival data.

Unit 10: Kidney donation – live donation – non related / related donors, cadaver.

4 Hours

- Cadaver organ harvesting and preservation
- Kidney preservation – solutions

Unit 11: Transplant surgery + potential complications – Pre - OP care/Surgical technique, post OP management/ potential complications.

4 Hours

Unit 12: Immunosuppressive therapy – Induction protocols/ maintenance protocols.

2 Hours

- AZA/ Steroids/ CSA – Pharmacology – drug interactions

Unit 13: Antirejection therapy – Pulse corticosteroids / ALS / OKT3 4 Hours

- Clinical Approach to Allograft dysfunction – ATN/ CSA/hyperacute rejection

- Ace or Acute rejection / other causes of DGF/ late chronic dysfunction.
- Pathological diagnosis of Allograft dysfunction
- Recurrent Glomerulonephritis
- De-novo injury
- Medical complications – Infections disease – Time table – viral infections – CMV/EBV
- Bacterial Infection– UTI – Opp. Bact. Infections/ Fungal Infection
- Cardiovascular disease – HT
- Lipid disorders
- Liver disease – HBV/HCV
- Malignancy
- M,
- Diabetes Mellitus, hematological problems
- Pancreatic – Kidney transplantation
- Pediatric transplantation – problems.

## Learning Outcome:

- Elaborate renal transplantation and transplant immunology.

## Reference Books:


1. Danovitch GM, editor. Handbook of kidney transplantation. Lippincott Williams & Wilkins; 2009 Oct 1.
2. Morris P, Knechtle SJ. Kidney transplantation: principles and practice. Elsevier Health Sciences; 2008 Jun 30.
3. Chatterjee SN. Manual of renal transplantation. Springer Science & Business Media; 2012 Dec

## Course Title: Clinical Dialysis IV

**Practical Hours: 300 Hours** **Total Credits: 10**

## Course Objectives:

- Monitoring the dialysis patients for intra dialytic complications.
- Overall care of patient outcomes, addresses patient satisfaction scores and patient safety issues.
- Involve in the activities of hemodialysis assistants, technologists and auxiliary personnel on all shifts.

## Course Content:

In the Clinical Dialysis I the student will get experience in various aspects in dialysis unit under the supervision of experienced professionals and is expected to work and contribute in the dialysis unit.

## SEMESTER IV

| Course Code | Course Title | Credits Distribution ( L, T, P per Week) | | | | Marks Distribution | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total Credits | Theory | | Practical | | |
| | | | | | | IA | ESE | IA | ESE | |
| Core | Recent Advances in Dialysis and Nephrology | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Psychosocial Issues & Rehabilitation in dialysis patient | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Renal Transplantation | 2 | 2 | | 4 | | | | | 150 |
| Core | Clinical dialysis IV | | | 20 | 10 | | | 60 | 90 | 150 |
| | Total Credits and Total Marks | | | | 22 | | | | | 600 |