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 MEDICAL IMAGING TECHNOLOGY

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

**Structure of the program clearly indicating courses, credits/Electives**

**Ref. Page No. 42-43, 56-57**

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 for

M.Sc. Medical Imaging 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 post graduation 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 post graduation 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.

A master's in Medical Imaging degree can prepare graduates to become radiographers, who assist radiologists and other medical doctors with advanced patient care, imaging, and diagnostic procedures knowledge. Individuals who pursue an administrative track may work as medical and health service managers. Additionally, graduates from an education and teaching master's degree program may work as post secondary healthcare speciality teachers. Graduates may even pursue PhD and even enter R&D sections of reputed companies manufacturing medical imaging equipments

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 basic and advanced physics, principle, instrumentation and application of various imaging modalities

In particular they will:

**PO 1:** Function as competent advanced level medical imaging technologists

**PO 2:** Demonstrate the ability to use theoretical knowledge and critical thinking skills in clinical practice.

**PO 3:** Have an advanced theoretical knowledge on all the modalities.

**PO 4:** modify the protocols according to the demand and need

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

**PO 5:** Train students in routine/special imaging procedure on different modalities

**PO 6:** select and operate different modalities as per to the need of physician

**PO 7:** Upgrade knowledge and skills in a changing healthcare scenario

**PO 8:** Should be capable of supervise / guide the staff working on various advanced modalities

**PO 9:** provide best clinical information to the physician

**PO 10:** Should be capable of teaching, proposing/executing research project

## 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 Medical Imaging 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. Medical Imaging Technology (MIT) or B.Sc. Radiography 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. Medical Imaging 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, 3P2etc.

**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 attendingthe semester.
b. There shall be no provision for condonation of shortage ofattendance.
c. For SWAYAM/MOOC/NPTELit shall be as per the regulations governing the courses of implementingauthority.
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 ascancelled.

## 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 eachcourse.

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 be60%.
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 evensemesters
g. The SEE duration shall be threehours.
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. MIT 4$^{th}$ Semester 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 below 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: Instrumentation and Physics of Radiography

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

**Learning Objectives:**

- To understand the general physics related to Medical imaging technology.
- Construction and working of Equipments used in x- ray.
- Application of Equipments in Medical Imaging Technology.

**Course Content:**

**Unit 1:**

1. Generation of electrical energy
2. Distribution of electrical energy
3. Uses of electricity in hospitals
4. Safety rules for technologist

**UNIT 2:**

1. X ray circuit components
2. High tension transformers
3. Main voltage compensation
4. High tension switches
5. Stabilizers and UPS

**UNIT 3:**

1. Fuses
2. Switches
3. Earthing
4. High tension cables constructions and design
5. Rectifications
6. Types of rectifiers

**UNIT 4 :**

1. Transformers and its types

**UNIT 5:**

1. Tube rating
2. Types of generators

**UNIT 6:**

1. Switches
2. Circuit breakers
3. Exposure switching and its application
4. Magnetic relay
5. Thermal relay switches
6. Interlock in tube circuit and over load inter interlocks

**UNIT 7 :**

1. Exposure Timers
2. Timing systems
3. Electronic timer
4. Ionization timer
5. Photo timer
6. Synchronous timer and impulse timer

**UNIT 8**

1. Devices improving radiographic quality
2. Cone
3. Cylinder
4. Collimator
5. Grid
6. Filter

**UNIT -9**

1. Portable & Mobile equipments
2. Mains requirements
3. Cable connections to wall plugs
4. Portable X-Ray Equipments
5. Mobile X-Ray Equipments
6. Capacitor Discharge Mobile Equipment

7. Cordless Mobile Equipments
8. X-Ray Equipments for the Operating Theatre
9. Mobile Image Intensifier units

**UNIT 10**

1. Fluoroscopy Equipments
2. Construction & Working principles of Image Intensifier
3. Viewing the Intensified image
4. Recording the intensified Image
5. Digital fluoroscopy
6. Panel type image intensifier

**UNIT 11**

1. Fluoroscopic / Radiographic Tables
2. General features of fluoroscopic / radiographic table
3. The serial changer
4. Remote control table
5. The spot film devices.

**UNIT 12**

1. Tomographic Equipment
2. Principles of tomography
3. Various types of tomographic movement
4. Equipment for linear tomography

**UNIT 13**

1. Equipment for Cranial and Dental radiography
2. The skull table
3. General Dental X-ray equipment
4. Pantomography equipment
5. Equipment for Cranial & skeletal radiography
6. Equipment for mammography

**UNIT 14**

1. Care, Maintenance and tests
2. General care Functional tests
3. Quality assurance program
4. Acceptable limits of variation Corrective action

**Reference Books:**


1. Chesney DN, Chesney MO. X-ray equipment for student radiographers. 3.
2. Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins; 1990.
3. Thompson TT. Practical approach to modern x-ray equipment.

# Course Title: Principles of Exposure and Image Processing

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

**Learning Objectives:**

- Construction and working of film, intensifying screen, cassette, dark room, computed radiography, direct radiography, automatic processor.
- To understand radiographic film Processing chemistry .
- To study the factors affecting image quality in radiographic image and their application.

**Course Content:**

**Unit 1**

1. X- ray production
2. Interaction of radiation with matter
3. Useful range of Electro Magnetic Radiation
4. Clinical applications

**Unit 2**

1. The Photographic Process
2. Basic review of photographic emulsion
3. Photographic latent image
4. Film materials
5. Speed and contrast of photographic material
6. Intensifying screens and cassettes
7. Film processing

**UNIT 3**

1. Sensitometry
2. Photographic density
3. Opacity
4. Transmission
5. Production of characteristic curve

6. Features of characteristic curve
7. Variation in the characteristic curve with development
8. Comparision of emulsion by their characteristic curve
9. Application of characteristic curve
10. Information from the characteristic curve

**UNIT 4**

1. Radiographic image
2. Radiographic density
3. Acceptable range
4. Factors influences density
5. Radiographic contrast
6. Components
7. Factors influence contrast
8. Management of radiographic image quality

**UNIT 5**

1. Resolution
2. Line spread function & modulation transfer function
3. Unsharpness in the radiographic image and various factors contributing towards unsharpness
4. Types of unsharpness
5. Radiographic mottle

**UNIT 6**

1. Geometry of the radiographic image
2. Magnification / distortion – types and factors

**UNIT 7**

1. Instrumentation of processing equipment
2. Automatic film processor (AFP)
3. Layout and planning of dark room
4. Viewing accessories : viewing boxes
5. Magnifiers and viewing conditions

**Reference Books:**


1. Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins; 1990.
2. Ball J, Price T. Chesneys' radiographic imaging. 5.
3. Forster E. Equipment for diagnostic radiography. Springer Science & Business Media; 1985 Dec 31.

## Course Title: Basic and Advanced Techniques of Imagining and Processing

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

**Course Objectives:**

- Understand the basic and advance physics behind x-ray
- Construction and working of Equipments used in x- ray.
- Construction and working of film, intensifying screen, cassette, dark room, computed radiography, direct radiography, automatic processor

**Course Content:**

1. Computerized Radiography
2. Digital Radiography
3. Devices improving radiographic quality
4. Portable & Mobile equipments
5. Digital fluoroscopy
6. Sensitometry
7. Application of characteristic curve
8. Resolution
9. Automatic film processor (AFP)
10. PACS , DICOM
11. Macroradiography
12. Microradiograph

# 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,
4. Trivandrum.
5. Lancaster H.O: Introduction to medical statistics, Johnwiley& sons, New York.
6. Leius A.E : Biostatistics, Reinhold publishing Co, New York.
7. Cotton T : Statistics in medicine, Little Brown & Co, Boston.
8. 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 | Instrumentation And Physics Of Radiography | 3 | 1 | - | 4 | 60 | 90 | | | 150 |
| Core | Principles Of Exposure And Image Processing | 3 | 1 | - | 4 | 60 | 90 | | | 150 |
| Core | Basic And Advanced Techniques Of Imaging And Processing | | | 20 | 10 | | | 60 | 90 | 150 |
| Subsidiary | Biomedical Research and Biostatistics | 2 | | - | 2 | 10 | 40 | | | 50 |
| | Total | | | | 20 | | | | | 500 |

**SEMESTER II**

# Course Title: Radiographic Positioning and Procedures

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

**Learning Objectives:**

- to distinguish indications and contra indications for procedure based on patient history
- to classify the contrast media based on solubility and physiology of excretion
- to assist radiologist by setting the equipment required for procedure

**Course Content:**

**UNIT 1**

**Skull:**

Related anatomy of Skull

Associated pathology and radiographic appearance

Radiographic projections - Routine and Special views

**UNIT 2**

**Vertebral Column:**

Related anatomy of Vertebral Column

Associated pathology and radiographic appearance

Radiographic projections - Routine and Special views

**UNIT 3**

**Mammography**

Related anatomy and Physiology

Associated pathology and radiographic appearance

ICRP guidelines

BIRADS

Radiographic projections - Routine and Special views

**UNIT 4**

**Upper limb**

Related anatomy of Upper limb

Associated pathology and radiographic appearance

Radiographic projections - Routine and Special views

**UNIT 5**

**Pelvis**

Related anatomy

Associated pathology and radiographic appearance

Radiographic projections - Routine and Special views

Pelvimetry

**UNIT 6**

**Lower limb**

Related anatomy of **Lower limb**

Associated pathology and radiographic appearance

Radiographic projections - Routine and Special views

**UNIT 7**

**Dental Radiography**

Related anatomy

Associated pathology and radiographic appearance

Radiographic projections - Routine and Special views

Intra oral and Extra oral View

OPG and Cephalometry

CBCT and Recent Advancement

**UNIT 8**

**Contrast Media**

Physiology

Application & types

Contrast Reactions

Safety aspects

Mode& volume of administration

Administration techniques

Catheters

Guide wires and other tools

**UNIT 9**

**Digestive System**

Anatomy and physiology

Associated pathology and radiographic appearance

Special studies

Barium swallow

Barium meal

Barium meal follow through

Enteroclysis

Barium enema

Loopogram

**UNIT 10**

**Hepatobiliary system**

Anatomy and physiology

Associated pathology and radiographic appearance

Percutaneous Transhepatic cholangiography

PTBD

ERCP

T – tube cholangiography

**UNIT 11**

**Genito urinary system**

Anatomy and physiology

Associated pathology and radiographic appearance

Intravenous urogram (IVU)

Micturating Cystourethrogram (MCU)

Ascending Urethrogram (ASU)

Retrograde Urethrogram (RGU)

Hysterosalpingography (HSG)

Fallopian Tube Recanalisation (FTR)

**UNIT 12**

**Cardio - Respiratory system**

Related anatomy and physiology

Associated pathology and radiographic appearance

Bronchography

Percutaneous lung Biopsy

**UNIT 13**

**Other Procedures**

Related anatomy and physiology

Associated pathology and radiographic appearance

Angiography

Plebography

Sialography

Dacrocystography

Sinography

Fistulography

Arthrography

**Reference Books:**


1. Whitley AS, Jefferson G, Holmes K, Sloane C, Anderson C, Hoadley G. Clark's Positioning in Radiography 13E. crc Press; 2015 Jul 28.
2. Frank ED, Long BW, Rollins JH, Smith BJ. Merrill's Atlas of Radiographic Positioning and Procedures-E-Book: Volume 1. Elsevier Health Sciences; 2013 Aug 13.
3. Lakhkar B. Radiological Procedures–A guideline. Ed. 3.
4. Chapman S, Nikielny R. A guide to radiological procedures.

# Course Title: Radiation Protection and management in Radiology

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

**Learning Objectives:**

- to identify the protective measures to be taken in the department
- to choose appropriate exposure factors
- to implement radiation surveys effectively

**Course Content:**

**UNIT 1**

Introduction to Radiation Protection

Need for protection

Aim of radiation protection

Basic radiation units and quantities Exposure

Absorbed dose equivalent Quality factor

Tissue weighting factor

**UNIT 2**

Limits for Radiation exposure

Concept of ALARA (or ALARP)

ICRP regulation

Maximum permissible dose

Exposure in children, pregnancy

**UNIT 3**

Protection in Diagnostic Radiology

Protection for primary radiation

Protection for scatter and leakage radiation

Work load

Occupancy factor

Use factor

X-Ray room design

Structural shielding

Protective devices

Radiation signages

**UNIT 4**

Technical Protective Consideration during Radiography

Protection in Fluoroscopy

Mammography,

Mobile radiography

CT Scan

Angiography room

Evaluation of hazards

Effective communication

Immobilization

Beam limiting devices

Filtration

Exposure factors

## UNIT 5

**Radiation measuring instruments**

Area monitoring devices

Personnel dosimeters

Thermo luminescent dosimeter

Film badge

Pocket dosimeter

## UNIT 6

**Biological aspects of Radiological protection**

Direct & Indirect effects of radiation

Concept of detriment – Deterministic & stochastic effect of radiation – somatic and genetic effects

Dose relationship

Effects of antenatal exposure

**Reference Books:**


1. Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins; 1990.
2. Sherer MA, Visconti PJ, Ritenour ER, Kelli Haynes MS. Radiation protection in medical radiography. Elsevier Health Sciences; 2013 Dec 4.
3. ICRP MANUAL

# Course Title: Basic and Advanced Instrumentation in CT

**Number of Theory Hours:45** **Total Credits: 3**

**Number of Practical Hours: 30**

**Learning Objectives:**

- understand the advanced principle of computed tomography
- to have an idea of components of CT and its relation in image formation
- complete knowledge about the protocols done in CT

**Course Content:**

**UNIT 1**

Basic CT Imaging principles in computed tomography

CT Generations

Instrumentation of CT scan

Advancement in Detector technology

Slip ring technology

Helical CT Single slice and Multi slice CT Scan system

**UNIT 2**

**Image Formation**

Image display

Pre Processing techniques

Post Processing techniques and advancement

Image quality in single slice and multi slice helical CT scan

Dose reduction strategies in CT

Isotropic Imaging

CT Dosimetry

**UNIT 3**

**HRCT Protocol:**

Lungs (THORAX)

Temporal bone

Technical aspects

Volumetric HRCT

Expiratory HRCT

CT Artefacts

**UNIT 4**

CT Protocols for paediatric and adults:

CT angiography

CT fluoroscopy

Multidimensional reformations MPR,

Curved MPR,

MIP 3D imaging & 4D CT

**UNIT 5**

Advanced Techniques in :

CT Perfusion scanning

Dentascan

CT bronchoscopy

CT colonoscopy

**UNIT 6**

**Cardiac Imaging**:

CT coronary angiography

CT calcium scoring

Protocols for paediatric Whole Body

Protocols for adult Whole Body CT

CT Documentation

**UNIT 7**

**Care, Maintenance and Tests**

General care

Functional tests

Quality assurance program

Acceptable limits of variation and Corrective action

**Reference Books:**


1. Seeram E. Computed Tomography-E-Book: Physical Principles, Clinical Applications, and Quality Control. Elsevier Health Sciences; 2015 Sep 2.

2. Bushong SC. Radiologic Science for Technologists E-Book: Physics, Biology, and Protection. Elsevier Health Sciences; 2020 Dec 2.

# Course Title: Methods of Radiation Protection Evaluation and Imaging Techniques of CT and Procedures

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

**Course Objectives:**

- to distinguish indications and contra indications for procedure based on patient history
- to classify the contrast media based on solubility and physiology of excretion
- to identify the protective measures to be taken in the department
- to choose appropriate exposure factors
- understand the advanced principle of computed tomography
- to have an idea of components of CT and its relation in image formation

**Course Content:**

In the Basic and Advanced Techniques of Imaging and Processing will get experience in various aspects in Radiological units under the supervision of experienced professionals and is expected to work and contribute in the Radiological units.

**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 | Radiographic Positioning And Procedures | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Radiation Protection And Management In Radiology | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Basic And Advanced Instrumentation In Ct | 2 | | 2 | 3 | 60 | 90 | | | 150 |
| Core | Methods Of Radiation Protection Evaluation And Imaging Techniques Of Ct And Procedures | | | 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: BASIC AND ADVANCED INSTRUMENTATION OF ULTRASOUND AND DOPPLER

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

**Learning Objectives:**

- to infer different protocols used for various anatomical regions
- to memorize physics beyond ultrasound imaging
- to define the advancements in ultrasound and doppler imaging

**Course Content:**

**UNIT 1**

**Ultrasound:**

Properties of ultrasound

Characteristics of ultrasound

Interaction of ultrasound with matter

**UNIT 2**

**Transducers**

Types of transducers

Advancement in the design of modern ultrasound transducers

**UNIT 3**

**Image display**

Ultrasound Display modes

Ultrasound instrumentation

Controls

Image storage

Scan converter memory

Pre and post processing techniques

Photographic film

Multi format camera

Laser imager

Colour and video thermal printer

Computer storage

**UNIT 4**

**Doppler imaging**

Doppler principles

Continuous wave Doppler and pulsed Doppler

Duplex scanning

Colour flow imaging

Power Doppler

Harmonic imaging

Extended field of view

**UNIT 5**

Ultrasound contrast agents

**UNIT 6**

Image characteristics

Vascular

Interventional

Intraoperative and ophthalmic ultrasonography

3D and 4D ultrasound imaging

Ultrasound artifacts

Doppler artifacts

**UNIT 7**

Bio – effects and safety consideration in ultrasound

Ultrasound system performance measurements

Ultrasound equipments quality assurance – conventional & Doppler system testing

Ultrasound Documentation

**UNIT 8**

Ultrasound protocols

**References Books:**


1. Rumack CM, Levine D. Diagnostic ultrasound E-book. Elsevier Health Sciences; 2017 Aug 8.
2. Choi J, Nguyen B. Essentials of ultrasound physics, James A. Zagzebski, Mosby, Philadelphia, Pa (1996), 230 pp, 400+ illustrations, softcover.
3. Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins; 1990.

## Course Title: Nuclear Medicine Imaging and Basics of Radiation Therapy

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

**Learning Objectives:**

- to have knowledge of proper handling of radioactive sources.
- to know how the radiation will be detected by radiation detection devices

**Course Content:**

**UNIT 1**

Basic atomic and nuclear physics

Atomic composition and structure

Quantities activity

Nucleus composition

Radioactivity

- Exponential decay
- Specific activity
- Parent/Daughter decay
- Modes of Radioactive decay

**UNIT 2**

Radiation detectors

Gas filled detectors-Basic principles

Ionization chambers

Geiger Muller counters

Proportional counters

Semiconductor detectors

Scintillation detectors-basic principles

**UNIT 3**

Instrumentation

Basic principles

System components

Detector systems and electronics

Collimators

Scanning cameras

Image display an recording systems

**UNIT 4**

Production of radio nuclides

Reactor produced radio nuclide

Reactor principles

Accelerator produced radionuclide

Radionuclide generators

**UNIT 5**

Radio pharmacy

Radiopharmaceuticals

General principles of tracer technique

Cold kits

Preparation of different labelled compounds with technetium-99m isotope

**UNIT 6**

In vivo technique

Static and dynamic studies

Thyroid imaging

Imaging of bone

Respiratory system

G.I system

Urinary system

Cardiovascular system

Iodine 131 uptake studies

Iodine 131 therapy of thyrotoxicosis and thyroid ablation

**UNIT 7**

Image quality in nuclear medicine

Spatial resolution

Contrast

Noise

Types of noise

Variation in image -with physician, within technologist and technical

Quality assurance of imaging equipments

**UNIT 8**

SPECT imaging

PET imaging

**UNIT 9**

Radiation safety in nuclear medicine

Radiation units quantities

MPD

Safe handling of radioactive materials

Storage of radioactive materials

Procedures for handling spills

Disposal of radioactive waste

Personnel dosimeters

Wipe testing

Contamination monitor

Isotope calibrator

Inventory of isotopes

Radiation monitoring

Survey meters

Area monitors

**Recommended Books:**


1. Cherry SR, Sorensen JA, Phelps ME. Physics in Nuclear Medicine. 2003: Saunders.
2. Powsner RA, Powsner ER. Essential nuclear medicine physics. John Wiley & Sons; 2008 Apr 15.

# Course Title: PATIENT CARE AND TECHNIQUES OF ULTRASOUND AND NUCLEAR MEDICINE

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

**Course Objectives:**

- to infer different protocols using practical knowledge of various anatomical regions
- to memorize physics beyond ultrasound imaging
- to have knowledge of proper handling of radioactive sources
- to know how the radiation will be detected by radiation detection devices

**Course Content:**

In Patient Care and Techniques of Ultrasound and Nuclear Medicine will get experience in various aspects in ultrasound and nuclear medicine under the supervision of experienced professionals and is expected to work and contribute in the Radiological units.

# 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 andICU.
- Organizational Structures - To learn to meet special challenges posed by human behavior in workplace of 21stcentury
- Quality management - To create an awareness about the process of applying for and implementing various accreditation process in healthcarefacilities.

**Course Content:**

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

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

**Unit II: Management of HealthcareOrganizations** **5 hours**

- Introduction toManagement
- Evolution & Theories ofManagement
- Management Functions:Planning
- Organizing
- Controlling
- DecisionMaking
- Staffing
- Techniques inManagement

**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 IdentityTheory
- OrganizationalCulture
- Communications in anOrganization

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

- Demand &Supply
- Nature ofCosts
- Marginal cost and breakevenanalysis
- Market structure: Business & Government, Roleof Government

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

- Budgeting & Budgetary control - Classificationof budget, P & L, BalanceSheets
- Types of Accounts, Debit &Credit
- Financial Statement Analysis

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

- Departmentation inHospital
- Outpatient, InpatientServices
- Intensive Care Unit, EmergencyServices
- Laboratory,Radiology
- Organizing of support services, UtilityServices
- Evaluation of Hospital services – HospitalStatistics
- 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 LMPrasad
2. Organizational Behaviour by StephenRobbins
3. Hospital Planning & Administration by B.M.Sakharkar
4. Hospital Administration by CMFrancis
5. Financial Management in Hospitals, Kulkarni, Satyashanker, AnilGomes.

## 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 | Basic And Advanced Instrumentation Of Ultrasound And Doppler | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Nuclear Medicine Imaging And Basics Of Radiation Therapy | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Patient Care And Techniques Of Ultrasound And Nuclear Medicine | | | 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: Basic and Advanced Instrumentation of MRI

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

**Learning Objectives:**

- To understand the advanced principle of MRI
- to have knowledge about the things restricted in MRI to carry
- to perform scans with ideal sequences

**Course Content:**

**UNIT 1**

**Basic principles**

Spin

Precession

Relaxation time

Pulse cycle

T1 weighted image

T2 weighted image

Proton density image

**UNIT 2**

**MR instrumentation**

Types of gradients

RF transmitter and receiver coils

Gradient coils

Shim coils

RF shielding

Computers

**UNIT 3**

**Pulse sequence**

Spin echo pulse sequences – turbo spin echo pulse sequences

Gradient echo sequence – turbo gradient echo pulse sequence

Inversion recovery sequence - STIR sequence , SPIR sequence, FLAIR sequence

Echo planar imaging & Fast imaging sequences

Advanced pulse sequences

**UNIT 4**

**Image formation**

2D fourier transformation method

K space representation

3D fourier imaging

MIP

**UNIT 5**

MR contrast media

MR angiography – TOF & PCA

MR spectroscopy

**UNIT 6**

Protocols in MRI for whole body

MRI artefacts

Safety aspects in MRI

**UNIT 7**

Cardiac MRI

**UNIT 8**

Musculoskeletal imaging protocols

Abdominal imaging protocols

**UNIT 9**

Functional imaging techniques

BOLD imaging

**UNIT 10**

Care, maintenance & tests

General care

Functional tests

Quality assurance programme

Acceptable limits of variation

Corrective action

**References Books:**


1. Westbrook C, Talbot J. MRI in Practice. John Wiley & Sons; 2018 Oct 22.
2. Bushong SC, Clarke G. Magnetic Resonance Imaging-E-Book: Physical and Biological Principles. Elsevier Health Sciences; 2013 Aug 7.
3. Hashemi RH, Bradley WG, Lisanti CJ. MRI: the basics: The Basics. Lippincott Williams & Wilkins; 2012 Mar 28.
4. Horowitz AL, Horowitz AL. MRI physics for radiologists. Springer; 1992.

# Course Title: Interventional Radiology

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

**Learning Objectives:**

- To have a good idea on vascular anatomy
- To distinguish the types of catheters and their uses
- To have and understanding on the various equipments used in cath-lab.

**Course Content:**

**UNIT 1**

Introduction

Need for interventional procedures

**DSA:**

Basic principle

Types

**Equipments:**

Basics of angiographic equipments

Single and biplane angiographic equipments

Angiographic table

Image intensifier

Flat panel detectors

Recording systems

Pulseoximetry

Cardiac resuscitation measure - ECG

Pressure injector

Catheters, needles & other tools

3D rotational angiography

Image processing

Patient monitor

$Co_2$ angiography

**UNIT 2**

**Patient care:**

Preparation for procedure

Post procedure care

Role of radiographer in interventional procedure

Crash trolley – Emergency drugs

**UNIT 3**

**Procedures:**

Diagnostic & therapeutic interventional procedures

PTC, PTBD, Stending

Nephrostomy, ureteric stending

Guided biopsies of different organs

Drainage of collections / abscesses

Angiograms, angioplasty, embolization

Venus access

Radiofrequency ablation

Cryoablation

Image guided nerve blocks

Phlebography

Direct portal venography

TIPS & TACE

**UNIT 4**

Neuro interventional procedures

Embolization of extra or intracranial tumors, vascular malformations

Vetebroplasty – direct puncture

Laser guided procedure

**UNIT 5**

Basics of cardiac catheterization

**UNIT 6**

Safety considerations in angiography room

Room design

Protective devices

Radiation monitoring

**UNIT 7**

Care, maintenance and tests:

General care

Functional tests

Quality assurance program:

Acceptable limits of variation

Corrective action

**References:**


1. Watkinson AF, Adam A, editors. Interventional radiology: a practical guide. Radcliffe Publishing; 1996.
2. Valji K, Maroney TP. Vascular and interventional radiology.
3. Snopek AM. Fundamentals of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.

# Course Title: Patient Care in Radiology

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

**Learning Objectives:**

- know precautions to handle emergency patients of different pathology
- to be able to perform basic and advanced life support to the patient in case of emergency
- to know the emergency drugs used in the department

**Course Content:**

**UNIT 1**

Introduction to the patient care

Responsibility of the health care facility

Responsibilities of the Imaging technologist

**UNIT 2**

General patient care

Patient transfer technique

Restraint technique

Aspects of patient comfort

Specific patient conditions

Security of the patient property

Obtaining vital signs

Laying up a sterile trolley

IV injection administration

**UNIT 3**

Nursing procedure in radiology

General abdominal preparation

Clothing of the patient

Giving an enema

Handling the emergencies in radiology

First aid in the x ray departments

**UNIT 4**

Patient care during investigation

GI tract, biliary tract, respiratory tract, gynaecology, cardiovascular, lymphatic system, C N S. etc

**UNIT 5**

Infection control

Isolation technique

Infection source

Transmission modes

Procedures

Psychological considerations

Sterilization & sterile technique

**UNIT 6**

Patient education

Communication

Patient communication problems

Explanation of examinations

Radiation safety/ protection

Interacting with terminally ill patient

Informed consent

**References Books:**


1. Ehrlich RA, Coakes DM. Patient care in radiography-e-book: with an introduction to medical imaging. Elsevier Health Sciences; 2016 Jan 19.
2. Chesney DN, Chesney MO. Care of the patient in diagnostic radiography. Blackwell Scientific Publications; 1973.

# Course Title: PATIENT CARE & TECHNIQUES OF CLINICAL MRI AND INTERVENTIONAL RADIOLOGY

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

**Course Objectives:**

- To have a practical understand advanced techniques of MRI
- to have knowledge about the things restricted in MRI to carry
- to have a good idea on vascular anatomy
- to distinguish the types of catheters and their uses
- know precautions to handle emergency patients of different pathology
- to be able to perform basic and advanced life support to the patient in case of emergency

**Course Content:**

In Patient Care & Techniques of Clinical MRI and Interventional Radiology the student will get experience in various aspects of patient care, MRI and interventional radiology under the supervision of experienced professionals and is expected to work and contribute in the radiology 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 | Basic And Advanced Instrumentation Of Mri Basic And Advanced Instrumentation Of Mri | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Interventional Radiology | 2 | 2 | - | 4 | 60 | 90 | | | 150 |
| Core | Patient Care In Radiology | 2 | 2 | | 4 | | | | | 150 |
| Core | Patient Care & Techniques Of Clinical Mri And Interventional Radiology | | | 20 | 10 | | | 60 | 90 | 150 |
| | Total Credits and Total Marks | | | | 22 | | | | | 600 |