SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

(A Deemed to be University Declared under Section 3 of UGC Act, 1956)
Comprising Sri Devaraj Urs Medical College
[Constituent Unit of Sri Devaraj Urs Educational Trust for Backward Classes (Regd.)
]TAMAKA, KOLAR-563103, KARNATAKA, INDIA
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(With effect from 2024-25 batches)

Choice Based Credit System

Curriculum for Master of Science in Medical Radiology & Imaging Technology

Approved: as per resolution of the (Agenda No. EC/LXXIX-12 / 2024), 79th Executive Council held on 28/06/2024

UGC GUIDELINES ON ADOPTION OF CHOICE BASED CREDIT SYSTEM (2023)

TO MASTER PROGRAMS

2023

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH
(Declared as Deemed - to - be University u/s 3 of the UGC Act)
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No. SDUAHER/KLR/ADMN/ 3575 /2023-24 Date: 22nd Jan. 2024

NOTIFICATION

Sub: Starting of M.Sc. Medical Radiology and Imaging Technology program in the Department of Allied Health Sciences.

Ref: 1. Proceedings of the 45th meeting of the Academic Council held on 4th Dec. 2023.
2. Proceedings of the 76th meeting of the Board of Management held on 26th Dec. 2023.

As per the approval of Academic Council and Board of Management meetings cited at above reference, The Academy decided to start M.Sc. Medical Radiology and Imaging Technology program in the Department of Allied Health Sciences, FAH & BS from the academic year 2024-25.

Registrar

Registrar
Sri Devaraj Urs Academy of Higher Education and Research
Tamaka, Kolar - 563 103.

Copy to:

1. P.A. to V.C., SDUAHER.
2. The Dean, FoM, SDUAHER & Principal, SDUMC.
3. The Dean, FAH&BS, SDUAHER.
4. The Controller of Examinations, SDUAHER.
5. The Director, Academics, SDUAHER.
6. The Director, Q & C, SDUAHER.
7. All HoDs, FAH & BS, SDUAHER.
8. O/c.

UGC GUIDELINES ON ADOPTION OF CHOICE BASED CREDIT SYSTEM

1. Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India.

The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students.

Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students.

To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UG Chas formulated these guidelines. UGC issued circular D.O.No. F.1-2/2008 (XI Plan) dated March 2009 and further in its circular D.O.No.F-1-1/2014 dated 12th November 2014 has directed all the Universities in the country to implement the Choice Based Credit system (CBCS) scheme to the entire undergraduate and post graduate level degrees Programs mandatorily.

In compliance to the above, Sri Devaraj Urs Academy of Higher Education and research [SDUAHER] a deemed to be University has notified with vide No SDUAHER/KLR/ADMN/2063/16- 17 dated 20.10.16 and introduced CBCS for undergraduate Programs (B.Sc.) in order to achieve academic excellence, quality improvement and as administrative reforms. Based on this background, SDUAHER has framed REGULATION governing B.Sc. Programs under Faculty of Allied Health Sciences. As per the academic requirements, versatile and flexible option of CBCS adopted for graduate programs in the year 2016 in a Notification number SDUAHER/KLR/ADMN/1758/2016-17 dated 22.09.2016 and also based on the credit frame work for PG curriculum, national credit frame work, national skill qualification frame work, Masters programs offered under Faculty of Allied Health and Basic sciences in the Academy also subjected for implementation of the CBCS scheme

This facilitates flexible learning; multifaceted development of students with wide variety of courses viz core, electives in discipline specific, Ability enhancement and open to enhance their knowledge and skills. This qualitative change in the Programs is to the global requirements and aspiration of students and stake holders for mobility both within and across the geographical jurisdiction.

CBCS implementation brings desired uniformity in grading system and method for computing semester grade point average (SGPA) for semester performance and cumulative Grade Point average (CGPA) for overall program performance of students in the examinations.

2. Applicability of the Grading System

These guidelines shall apply to all undergraduate and postgraduate level degree, diploma and certificate programs under the credit system awarded by the Central, State and deemed to be universities in India.

3. Definitions of Key Words:

1. **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
2. **Choice Based Credit System (CBCS) :** The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).
3. **Course:** Usually referred to, as ‘papers’ is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to 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.
4. **Credit Based Semester System (CBSS):** Under the CBSS, the requirement for awarding a

degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.

5. **Credit Point:** It is the product of grade point and number of credits for a course.
6. **Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.
7. **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.
8. **Grade Point:** It is a numerical weight allotted to each letter grade on a 10-point scale.
9. **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.
10. **Programme:** An educational programme leading to award of a Degree, diploma or certificate.
11. **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.
12. **Semester:** Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to December and even semester from January to June.
13. **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 and CGPA earned till that semester.

4. Semester System and Choice Based Credit System

The Indian Higher Education Institutions have been moving from the conventional annual system to semester system. Currently many of the institutions have already introduced the choice based credit system. The semester system accelerates the teaching-learning process and enables vertical and horizontal mobility in learning. 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, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning, It is desirable that the HEIs move to CBCS and implement the grading system.

5. Types of Courses:

Courses in a programme may be of three kinds: Core, Elective and Foundation.

1. Core Course:-

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Elective Course:-

Elective course is a course which can be chosen from a pool of papers. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be "Generic Elective" focusing on those courses which add generic proficiency to the students. An elective may be "Discipline centric" or may be chosen from an unrelated discipline. It may be called an "Open Elective."

3. Foundation Course:-

The Foundation Courses may be of two kinds: Compulsory Foundation and Elective foundation. "Compulsory Foundation" courses are the courses based upon the content that leads to Knowledge enhancement. They are mandatory for all disciplines. Elective Foundation courses are value-based and are aimed at man-making education.

6. Examination and Assessment

The HEIs are currently following various methods for examination and assessment suitable for the courses and programs as approved by their respective statutory bodies. In assessing the performance of the students in examinations, the usual approach is to award marks based on the examinations conducted at various stages (sessional, mid-term, end-semester etc.,) in a semester. Some of the HEIs convert these marks to letter grades based on absolute or relative grading system and award the grades. There is a marked variation across the colleges and universities in the number of grades, grade points, letter grades used, which creates difficulties in comparing students across the institutions. The UGC recommends the following system to be implemented in awarding the grades and CGPA under the credit based semester system.

6.1. Letter Grades and Grade Points:

i. Two methods -relative grading or absolute grading– have been in vogue for awarding grades in a course. The relative grading is based on the distribution (usually normal distribution) of marks obtained by all the students of the course and the grades are awarded based on a cut-off marks or percentile. Under the absolute grading, the marks are converted to grades based on pre-determined class intervals. To implement the following grading system, the colleges and universities can use any one of the above methods.

ii. The UGC recommends a 10-point grading system with the following letter grades as given below:

Table 1: Grades and Grade Points

Letter Grade	Grade Point
O (Outstanding)	10
A+(Excellent)	9
A(Very Good)	8
B+(Good)	7
B(Above Average)	6
C(Average)	5
P (Pass)	4
F(Fail)	0
Ab (Absent)	0

iii. A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

iv. For noncredit courses 'Satisfactory' or "Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

v. The Universities can decide on the grade or percentage of marks required to pass in a course and also the CGPA required to qualify for a degree taking into consideration the recommendations of the statutory professional councils such as AICTE, MCI, BCI, NCTE etc.,

vi. The statutory requirement for eligibility to enter as assistant professor in colleges and universities in the disciplines of arts, science, commerce etc., is a minimum average mark of 50% and 55% in relevant postgraduate degree respectively for reserved and general category. Hence, it is recommended that the cut-off marks for grade B shall not be less than 50% and for grade B+, it should not be less than 55% under the absolute grading system. Similarly cut-off marks shall be fixed for grade B and B+ based on the recommendation of the statutory bodies (AICTE, NCTE etc.,) of the relevant disciplines.

6.2. Fairness in Assessment :

Assessment is an integral part of system of education as it is instrumental in identifying and certifying the academic standards accomplished by a student and projecting them far and wide as an objective and impartial indicator of a student's performance. Thus, it becomes bounden duty of a University to ensure that it is carried out in fair manner. In this regard, UGC recommends the following system of checks and balances which would enable Universities effectively and fairly carry out the process of assessment and examination.

i. In case of at least 50% of core courses offered in different programmes across the disciplines, the assessment of the theoretical component towards the end of the semester should be undertaken by external examiners from outside the university conducting examination, who may be appointed by the competent authority. In such courses, the question papers will be set as well as assessed by external examiners.

ii. In case of the assessment of practical component of such core courses, the team of examiners should be constituted on 50 – 50 % basis. i.e. half of the examiners in the team should be invited from outside the university conducting examination.

iii. In case of the assessment of project reports / thesis / dissertation etc. the work should be undertaken by internal as well as external examiners.

7. Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA\ (Si) = \sum(Ci \times Gi) / \sum Ci$$

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \sum(Ci \times Si) / \sum Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

7. Illustration of Computation of SGPA and CGPA and Format for Transcripts

i. Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade
Course 1	3	A	8	3 X 8 = 24
Course 2	4	B+	7	4 X 7 = 28
Course 3	3	B	6	3 X 6 = 18
Course 4	3	O	10	3 X 10 = 30
Course 5	3	C	5	3 X 5 = 15
Course 6	4	B	6	4 X 6 = 24
	20			139

Thus, SGPA =139/20 =6.95

Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit : 20 SGPA:6.9	Credit : 22 SGPA:7.8	Credit : 25 SGPA: 5.6	Credit : 26 SGPA:6.0
Semester 5	Semester 6		
Credit : 26 SGPA:6.3	Credit : 25 SGPA: 8.0		

Thus, CGPA = $\frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0}{144} = 6.73$

ii. Transcript (Format): Based on the above recommendations on Letter grades, grade points and SGPA and CCPA, the HEIs may issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

Note: 1200 hours / 40 credits per year at the level of 6.5 . Comprising 88 credits consists of (core 64, DSE 16, generic 8.) mandatory Non CGPA range from 8-14 comprising AEC 4, SEC 2/4, elective co/extra CC 2-6.

REGULATIONS GOVERNING MASTERS PROGRAMS

1. TITLE OF THE PROGRAM

Master of Science degree Program in M.Sc. in Medical Radiology & Imaging Technology (M.Sc. MRIT)

2. DURATION OF THE COURSE

The duration of the Master's Degree Program shall be for a period of two years (consists of four semesters) including submission of project work on the topic registered.

3. ELIGIBILITY FOR ADMISSION AND SELECTION CRITERIA

The students who have passed in Program from Institutions affiliated to UGC recognized Universities with B.Sc. in Medical Radiology& Imaging Technology/B.Sc. Medical Technology Radio diagnosis and Imaging/ B.Sc. Radiological Technology/B.Sc. in Radiography/B.Sc. Medical Technology (X-ray) with a minimum 50% marks are eligible.

The selection of the candidates for admission to the course is made on merit on the basis; however, entrance examination shall be conducted by the institute based on the number of applications.

Note: Selection of the students by the Entrance examination performance followed by personal interview by the institution according to the norms.

OR

diploma holders in Medical Radiology and Imaging Technology with 3-5 years of professional experience may be considered as the eligible candidates for the MSc. Program.

Note: Candidates passing B.Sc. degree in relevant area through Correspondence shall not be eligible.

4. MEDIUM OF INSTRUCTION

English shall be the medium of instruction for the subjects of study as well as for the Examination.

5. COURSE OF STUDY

The Program of the study shall include 4 semester, and to be pursued on full time basis. Duration of the course. Duration of the course: 4 semesters or 2 Years (590 hours of Theory & 750 hours of Practical Classes) and 850 hours of Resident Postings. Total hours – 2180

Note: Students shall be posted to clinical/department as per the university direction.

6. ATTENDANCE

Every candidate should have attended at least 75% of the total number of classes conducted in a semester from the date of commencement of the semester to the last working day asper Academic calendar notified by University in each of the subject/s prescribed for that year, separately, in theory and practical. Only such candidates are eligible to appear for the University examinations in their first attempt. A candidate lacking the prescribed percentage of attendance in any subject either in Theory or Practical will not be eligible to appear for the University Examination in that particular subject.

Note: No candidate shall join any other course of study or appear for any other examination conducted by this university or any other university in India or abroad during the period of study on regular mode.

7. MONITORING PROGRESS OF STUDY (WORK DIARY/RECORD BOOK)

Every candidate shall attend/present in symposia, seminars, conferences, journal club & lectures during each semester as prescribed by the department and not absent him/her from work without valid reasons. Every candidate shall maintain a work diary and record of his/her participation in the training Program. Special mention may be made of the presentations by the candidate as well as details of laboratory work conducted by the candidate. The work diary and record shall be scrutinized and certified by the Department.

8. INTERNAL ASSESSMENT (IA)

Institutions running the program /course shall conduct two tests each in every semester for Internal Assessment as per the University prescribed calendar of events. The marks obtained in these tests will be considered for internal assessment. Average of the two marks will be computed for internal assessment and shall be sent to the University as per the notification issued by Controller of examination before each semester end examination. Records and marks obtained in tests will be maintained by the Department / College and made available to the University. Marks of periodic tests shall be displayed on the Departmental notice board.

Note: If a candidate is absent for the test due to genuine and satisfactory reason, such a candidate may be given a re-test within a fortnight.

The distribution of marks for internal assessment for subjects of study in first year and second year are shown in Tables

Distribution of Internal Assessment marks

Example: Course: Master's program: Medical Radiology & Imaging Technology

SL. No.	Subject	Theory/ paper	Practical / paper
01	Theory Paper-1 Paper title:	20	10
02	Theory paper-II Paper title:	20	10
03	Theory paper-III Paper title:	20	10

NOTE: A student must secure at least 50% of total marks fixed for internal assessment for a particular subject in order to be eligible to appear in university examination in that subject. The internal assessment marks **will be added** to the marks obtained in the University (theory &Practical) examination for declaration of pass.

10. PROJECT / DISSERTATION WORK

Candidate pursuing M.Sc. program in the selected specialization i.e. AT&OT is required to carry out dissertation work on a chosen topic in the area of specialization under the guidance of a post graduate teacher after successful completion of first year of the course (1^{st} & 2^{nd} semester). However each candidate has to finalize project title and proposal in second semester, whereas he/she has to obtain Ethical clearance certificate for the project work in the second semester. Whereas, the candidate has to commence the project work during the third semester and should complete in the fourth semester. The completed project and its manuscript for publication should be kept ready before last date for project/ dissertation report submission. Project report shall be submitted to the University through Head of the Department duly certified by the Guide and student signature after plagiarism check.

The project/ dissertation work is aimed to kindle the research instincts among the students. The work should comprise adequate exposure to various research methodologies and techniques. This includes identification of problem, formulation of hypothesis, search and review of literature, getting acquainted with recent advances, collection of data, interpretation of results and drawing conclusions. University shall arrange for evaluation of the project work report both internally and externally and shall have to obtain 50% of the total marks allotted for the project/ dissertation work including viva voce (80 marks for project and 20 marks for viva voce as per Notification No SDUAHER /KLR /ADMN /2732/2020-21 dated 29th March 2021)

The project/ dissertation report shall have the following components in the template.

- Certificates
- Structured Abstract
- Introduction /background
- Review of literature
- Aims and objectives
- Materials and methods
- Results
- Discussion
- Summary
- Conclusion
- Scope of the future research
- References
- Tables / Annexure

The project/ dissertation work shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. A declaration by the candidate to the effect that the work was done by him/her and a certificate of bonafide on the research work have to be affixed in the beginning of the project/ dissertation report. Five copies of project report/ dissertation should be submitted to the University through proper channel along with a soft copy (CD) as per the calendar of events.

11. GUIDE

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

a) ELIGIBILITY TO BE A GUIDE

Shall be a full time teacher in the college or institution where he or she is working.

b) Academic qualification and teaching/professional experience for each M.Sc. branch

1. Ph.D. in MRIT
   or
2. M.D. in Radio-Diagnosis
   or

3 M.Sc. in MRIT with five years of teaching/professional experience after the postgraduate qualification in a teaching in Medical /Allied Health institution.

c) Age*:* The age of guide shall not exceed 65 years.

d) STUDENT: GUIDE RATIO

3:1. as a guide or co-guide shall supervise project work of not more than five students per academic year.

12. SCHEDULE OF EXAMINATION

a. The University conducts four semester examinations during Program period. Each year consists of two semesters; each semester consists of 90-100 working days. Examination should get over during the period of six months of a semester.

b. The number of examiners for practical and viva-voce shall be two, comprising of one internal and one external examiner appointed by the University.

c. Submission of HoD certified practical record book by a candidate shall be considered for award of internal assessment marks, and is prerequisite before attending practical examinations.

d. A failed candidate needs to appear for both theory and practical examination in the failed subject/s only in the subsequent examination. Where each course has theory and practical components. However, in case of courses having common practical, he/she failed in theory and passed in practical can only appear for the theory but not practical again

13. SCHEME OF EXAMINATION:

University examination:

There shall be four University semester end examinations during program duration. Students with backlogs subject are allowed to appear in odd and even semester examination when notified by Examination section (Notification no. SDUAHER/KLR/ADMN/2732/2020-21 dated. 29.03.2021)

Eligibility to appear in University examination

A candidate shall be eligible to appear for examination at the end of each semester in the Academic year from the commencement of the course. He/she should have satisfactorily completed the prescribed course fulfilment with prescribed attendance and internal assessment. Whereas, he/she must appear for the semester end examination to progress to the next semester irrespective of the results.

Note: submission of project in fourth semester is mandatory to take up examinations.

Written examination: Written examination shall consist of theory paper for three hours duration. Each paper shall carry 100 marks plus 20 IA marks and 30 marks viva voce examination added to theory. Therefore total is 150

Practical examination: There shall be practical examination at the end of each semester in first year and second year subjects. Each practical examination carries 50 marks comprising 40 practical and 10 marks for IA along with the viva voce examination, marks will be added to the theory.

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

Presentation of dissertation and discussion on it be done during the viva-voce. Both internal and external examiners shall conduct the practical and project viva- voce examination. The marks distribution is 80 projects / dissertation and 20 marks viva voce of project.

14. CRITERIA FOR PASS.

Pass criteria in a subject

To consider as pass in University semester end examination, candidate has to appear in all the papers prescribed in that semester and has to fulfil pass criteria. For declaration of pass in any subject in the University examination, the candidates shall pass both in theory and practical examinations components separately as stipulated below; Theory 50%, which includes marks obtained in written examination, internal assessment and viva voce. Practical 50% which includes marks obtained in practical examination, practical Internal assessment. A candidate has to pass in theory and practical separately to pass in a subject in the University examination. A failed candidate is required to appear for both theory and practical in the subsequent examination in that subject.

15. CARRY OVER

A Candidate who has admitted to postgraduate programs under the faculty of Allied health and basic sciences shall be permitted to carry over the backlog subject till the completion of duration of the programme. However, he/she has to appear for the previous examination to get the benefit of carryover. Candidate shall be declared passed in the programme only after successfully passing all the subject/ courses of all semesters of the post graduate programme and is eligible to receive degree in convocation to be held subsequent to the examination.

16 DECLARATIONS OF RESULTS

PASS:

Minimum marks for passing examination in theory is 50% (theory +viva voce+ internals assessment)

Practical is 50% (Practical + Internal assessment) Dissertation /Project report 50% (project + project viva voce

FIRST CLASS:

The student securing 60% marks or above aggregate in all subjects in a single attempt shall be declared to have passed in the First class.

DISTINCTION:

A candidate securing aggregate marks of 75% or more in the first attempt shall be declared as passed with distinction. Distinction will not be awarded for candidates passing the examination with more than one attempt.

17. MAXIMUM DURATION FOR COMPLETION OF COURSE

The maximum duration of the programme shall be double the duration of the program from the date of admission. The candidate failing to complete the course within four years from the date of admission will be declared unfit to continue and will be discharged from the programme.

ELIGIBILITY FOR AWARD OF DEGREE

A candidate shall have passed in all the subjects of semester I –IV to be eligible for award of degree.

18. REQUIREMENT OF MAN POWER AND INFRASTRUCTURE

1. Basic Infrastructure includes, Institute should have its own Hospital with full-fledged Anesthesia and OT facility to fulfill the minimum work load criteria.

Teaching staff requirement for each speciality

1) Professor – (01)

2.) Associate Professor (01)

3). Assistant Professor (01)

4). Demonstrator – (02)

Program structure

Semester	Course code	Core courses (1-19)	Discipline specific elective (DSE) (Non-core)	Ability enhancement Compulsory Course (AEC)	Skill enhancement courses (SEC)	Generic elective (GEC)	Foundation course
I	Core-1 Core-2 Core-3	Management &Planning of a Radiology & Imaging department including national & international guidelines. Modern Imaging Techniques including Fusion and hybrid imaging technologies (X ray) Advanced Physics of Radiology & Imaging	Biomedical waste management and infection control	- Digital health care technology	-	GEC-1 GEC-2 GEC-3	-
II	Core-4 Core-5 Core-6 Core 7	Radiation Safety and Protection- AERB guidelines Modern Radiological and Imaging Equipment (CT) Radiological and Imaging Procedures Biostatistics & Research Methodology	Basics law and ethics	Constitution and Human rights -	-	GEC-1 GEC-2 GEC-3	-
III	Core-8 Core-9 Core 10	Quality Assurance and Quality Control in Diagnostic Radiology and Imaging Newer Imaging Modalities (Ultrasound) Intervention Radiological Techniques and Care of Patient	-	Cyber security -	-	GEC-1 GEC-2 GEC-3	-
IV	Core-11 Project/ Dissertation	Newer Developments in Advanced Imaging Technology such as maxillo-facial imaging, dental radiology and other advanced modalities (MRI, Nuclear Medicine, PET) Project/Dissertation Seminars, Journal Club and Group Discussions	Disaster risk Management and climate control	-	-	GEC-1 GEC-2 GEC-3	-

FIRST SEMESTER M.Sc. IN MEDICAL RADIOLOGY & IMAGING TECHNOLOGY
DISTRIBUTION OF TEACHING HOURS & CREDITS

Sl. No.	Course Code	Category	Course Title	Theory		Practical	
				Hours / Sem	Credits	Hours / Sem	Credits
1	A101	Core Paper – I	Management &Planning of a Radiology & Imaging department including national & international guidelines.	60	4	110	**3**
2	A102	Core Paper – II	Modern Imaging Techniques including Fusion and hybrid imaging technologies (X ray)	60	4	110	**3**
3	A103	Core Paper – III	Advanced Physics of Radiology & Imaging	60	4	110	**3**
4	DSEC-01	Discipline specific elective course	Biomedical waste management and infection control	45	3	-	-
5	SEC-01	SEC	Digital Health care Technology	30	2	-	-
6	Soft Core - GE	Generic elective course (choose any one)	GEC-01-Basics of Hospital Administration GEC-02-Lifestyle disorders Basic computer applications	30	2	-	- -- -
TOTAL				**285**	**19**	**330**	**6**

First Semester M.Sc. in Medical Radiology & Imaging Technology

Distribution of Marks

Sl. No.	Course Code	Category	Course Title	Theory Marks				Practical Marks			TOTAL
				Theory	IA	Viva -Voce	Sub Total	Practical	IA	Sub Total	
1	A101	Core paper – 1	Management &Planning of a Radiology & Imaging department including national & international guidelines.	100	20	-	120	40	10	**50** Common practical	**120**
2	A102	Core paper – 2	Modern Imaging Techniques including Fusion and hybrid imaging technologies (X ray)	100	20	30	150				**200**
3	A103	Core paper -3	Advanced Physics of Radiology & Imaging	100	20	-	120				**120**
4	DSEC-01	Discipline specific elective course	DSEC-01- Biomedical waste management and infection control	40	-	-	40	-	-	-	**40**
5	SEC-01	SEC	Digital Health care Technology	40	-	-	40	-	-	-	**40**
6	Soft Core - GE	Generic elective course (t choose any one)	GEC-01-Basics of Hospital Administration GEC-02-Lifestyle disorders Basic computer applications	30	-	-		-	-	-	**40**
TOTAL				**420**	**60**	**30**	**510**	**40**	**10**	**50**	**560**

SECOND SEMESTER M.Sc. IN MEDICAL RADIOLOGY & IMAGING TECHNOLOGY
DISTRIBUTION OF TEACHING HOURS & CREDITS

Sl. No.	Course Code	Category	Course Title	Theory		Practical	
				Hours / Sem	Credits	Hours / Sem	Credits
1	B 101	Core Paper – I	Radiation Safety and Protection-AERB guidelines	60	4	140	**3**
2	B 102	Core Paper – II	Modern Radiological and Imaging Equipment (CT)	60	4	140	**3**
3	B 103	Core Paper – III	Radiological and Imaging Procedures	60	4	140	**3**
4	B 104	Core Paper – IV	Biostatistics & Research Methodology	30	2	-	-
5	DSEC-01	Discipline specific elective course	Basic medical law and ethics	30	2	-	-
6	AEC-1	SEC	Constitution and Human rights	30	2	-	-
7	GEC-1	Generic elective course (to choose any one)	GEC-1 Basic Life Support GEC-02 English for communication GEC-03 Basics of yoga and practice	30	2	-	--- - -
TOTAL				**300**	**20**	**420**	**9**

Second Semester M.Sc. in Medical Radiology & Imaging Technology
Distribution of Marks

Sl. No.	Course Code	Category	Course Title	Theory Marks				Practical Marks			TOTAL
				Theory	IA	Viva -Voce	Sub Total	Practical	IA	Sub Total	
1	C101	Core Paper – I	Radiation safety and protection AERB guidelines	100	20	30	150	40	**10**	**50**	**150**
2	C102	Core Paper – II	Advance instrumentation and techniques in CT-	100	20	30	150				**150**
3	C103	Core Paper – III	Magnetic Resonance Imaging -1	100	20	30	150				**200**
4	C104	Core Paper – IV	Biostatistics & Research Methodology	100	20		150				
5	DSEC-01	Discipline specific elective course	Basic Medical law and ethics	40	-	-	40	-	-	-	**40**
6	AEC-1	SEC	Constitution and Human rights	40	-	-	40	-	-	-	**40**
7	GEC-1	Generic elective course (to choose any one)	GEC-1 Basic Life Support GEC-02 English for communication GEC-03 Basics of yoga and practice	40	-	-	40	-	-	-	**40**
TOTAL				**420**	**60**	**90**	**570**	**80**	**20**	**100**	**670**

THIRD SEMESTER M.Sc. IN MEDICAL RADIOLOGY & IMAGING TECHNOLOGY
DISTRIBUTION OF TEACHING HOURS & CREDITS

Sl. No.	Course Code	Category	Course Title	Theory		Practical	
				Hours / Sem	Credits	Hours / Sem	Credits
1	C101	Core Paper – I	Quality Assurance and Quality Control in Diagnostic Radiology and Imaging	60	4	40	**2**
2	C102	Core Paper – II	Newer Imaging Modalities (Ultrasound) Intervention	60	4	-	-
3	C103	Core Paper – III	Radiological Techniques and Care of Patient	60	4	-	-
4		Discipline specific elective course	Cyber Security	40	2	-	-
	AEC	Ability Enhancement course	-	-	-	-	-
5	Soft Core	Generic elective course (to choose any one)	GEC-1 Scientific writing	40	2	-	-
			GEC-02 Vegetative propagation				
			GEC-03 apiculture				
TOTAL				260	16	40	**2**

Third Semester M.Sc. in Medical Radiology & Imaging Technology
Distribution of Marks

Sl. No.	Course Code	Category	Course Title	Theory Marks				Practical Marks			TOTAL
				Theory	IA	Viva -Voce	Sub Total	Practical	IA	Sub Total	
1	C101	Core Paper – I	Quality Assurance and Quality Control in Diagnostic Radiology and Imaging	100	20	30	150	40	**10**	**50**	**150**
2	C102	Core Paper – II	Newer Imaging Modalities (Ultrasound) Intervention	100	20	30	150				**200**
3	C103	Core Paper – III	Radiological Techniques and Care of Patient	100	20	30	150				**150**
4		Discipline specific elective course	DSEC-02 Cyber Security	40	-	-	40	-	-	-	**40**
	AEC	Ability Enhancement course	-	-	-	-	-	-	-	-	-
5	Soft Core	Generic elective course (to choose any one)	GEC-1 Scientific writing GEC-02 Vegetative propagation GEC-03 apiculture	40	-	-	40	-	-	-	**40**
TOTAL				320	40	60	**570**	**40**	**10**	**50**	**630**

Note: Project work commencement

FOURTH SEMESTER M.Sc. IN MEDICAL RADIOLOGY & IMAGING TECHNOLOGY
DISTRIBUTION OF TEACHING HOURS & CREDITS

Sl. No.	Course Code	Category	Course Title	Theory		Practical	
				Hours / Sem	Credits	Hours / Sem	Credits
1	D101	Core Paper – I	Newer Developments in Advanced Imaging Technology such as Maxillo-facial imaging, dental radiology and other advanced modalities (MRI, Nuclear Medicine, PET)	60	4	120	**4**
4		Project/Dissertation	Project/Dissertation	110	4	-	-
6		Discipline specific elective course	DSEC-02 Disaster risk management and climate control	40	2	-	-
7	Soft Core	Generic elective course (to choose any one)	GEC-1 Nutrition for Beauty GEC-02 Mushroom cultivation GEC-03 Basics of trading	40	2	-	-
TOTAL							

Fourth Semester M.Sc. in Medical Radiology & Imaging Technology
Distribution of Marks

Sl. No.	Course Code	Category	Course Title	Theory Marks				Practical Marks			TOTAL
				Theory	IA	Viva -Voce	Sub Total	Practical	IA	Sub Total	
1	D101	Core Paper – I	Newer Developments in Advanced Imaging Technology such as Maxillo-facial imaging, dental radiology and other advanced modalities (MRI, Nuclear Medicine, PET)	100	20	30	150	40	**10**	**50**	**200**
4		Project/Dissertation	Project/Dissertation	80	-	20	100	-	-	-	**100**
	DSEC-02	Discipline specific elective course	Disaster risk management and climate control	40	-	-	40	-	-	-	**40**
5	Soft Core	Generic elective course (to choose any one)	Nutrition and Health Mushroom cultivation Industrial exposure to MRIT instrumentation	40	-	-	40	-	-	-	**40**
TOTAL				260	20	50	**330**	**40**	**10**	**50**	**380**

SYLLABUS
M.Sc. in Medical Radiology & Imaging Technology

Learning Objectives:

The M.Sc. in Medical Radiology & Imaging Technology is designed to provide specialized training in the scientific principles of modern imaging science and in the application of these principles in the field of radio diagnosis. It is suitable for gradates having experience in the technology of imaging science. The objective is to train students in to qualified, patient focused, compassionate, critical thinkers Diagnostic Radiographer / Technologist for the community who are engaged in lifelong learning.

Upto successful completion of the M.Sc. course, students will have developed a broad knowledge of the principles, technology, instrumentation, recent developments and proper handling of the modern radiological equipments and proper execution of the various radiological procedures.

Expectation from the future graduate in the providing patient care

Perform a range of radiographic examinations on patient to produce high quality images.

1. Verifying informed consent, assuming responsibility for patient needs during procedures.
2. Applying principles of ALARA to minimize exposure to patient, self and others. Starting and maintaining intravenous access as prescribed, Identifying, preparing and/or administering medications as prescribed
3. Evaluating images for technical quality, ensuring proper identification is recorded.
4. Performing diagnostic radiographic and non-interpretive fluoroscopic procedures
5. Assist radiologists and senior staff in complex radiological examinations.
6. Record imaging identification and patient documentation quickly and accurately and observes protocols.
7. Research and development of new techniques and procedures as assigned.
8. Promotes effective working relationships and works effectively as part of a department / unit / team inter and intra departmentally to facilitate the department/unit's ability to meet itsgoals and objectives.
9. Follows established safety practices including biohazards, exposure control plan
10. Demonstrates respect and regard for the dignity of all patients, families, visitors and fellow employees to ensure a professional, responsible and courteous environment.
11. Identifying and managing emergency situations.
12. Performing ongoing quality assurance activities.
13. Ensure safe custody of all the accessories of the X-ray unit of which he/she is in charge.Keeps the X-ray room locked when not in use.
14. Understands and observes health and safety precautions and instruction for self and others protection. He/she should wear dosimeter during duty hours.
15. Attends all in service education required as per hospital policy.
16. Providing education. Educating and monitoring students and other health care providers.
17. Orientation and teaching students and new employees.
18. To supervise and allocate responsibilities to level 4 and level 5.
19. Learns new technologies and technologies as required by the professional bodies.
20. Impart appropriate training to the students and other staff.
21. Should have management and research skills.

22. To exhibit keen interest, initiative & drive in the overall development of the Department and 'Leadership Qualities' for others to follow.
23. He / She is expected to be confident and to perform all the duties diligently with utmost sincerity and honesty.
24. Any other duty/task/work assigned by any higher authority like Director, Dean, Medical Superintendent, Head of the Department from time to time; either in "Public Interest" or in the interest of upkeep / development of the Department / Institutions.

SEMESTER I

Paper -1 Title: Management and Planning of radiology department with compliance to national &international guidelines (Theory: 60 hours/ 4 credits)

1. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding materials Protection for primary radiation, work load, use factor, occupancy factor, protection from scatter radiation and leakage radiation, X-Ray/Fluoroscopy/Mammography/Intervention/DSA/CT room design, structural shielding, protective devices.

2. Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements. (ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection).

3. Surveys and regulations. Radiation protection survey: Need for survey. - Performance standards for beam directing, beam defining and limiting devices in radiation protection equipment survey of the following. a. Radiographic equipment b. Fluoroscopic equipment c. CT and special equipment. Controlled and non-controlled areas and acceptable exposure levels. State and local regulations governing radiation protection practice.

4. Personal monitoring and occupational exposures: Personal monitoring for Radiation workers. Monitoring devices. Body badges and ring badges. Thermo-luminescent dosimeters, Pocket ionization chambers. Applications, advantages and limitations of each device, Values for dose equivalent limits for occupational radiation exposures.

5. NABH guidelines, AERB guidelines and code, Basic safety standard, PNDT Act and guidelines.
6. Procedural safety
7. Achievable safety through compliance on the regulations in India and recommendations of ICRT, IAEA.
8. Role of Radiographer in Planning & Radiation Protection: Role of technologist in radiology department - Personnel and area monitoring., Setting up of a new X-Ray unit, staff requirement, AERB specifications for site planning and mandatory guidelines – Planning of X-ray/CT rooms, Inspection of X-Ray installations - Registration of X-Ray equipment

installation- Certification -Evaluation of workload versus radiation factors – Occupational exposure and protection Tools/devices.

9. Introduction to Management of a Radiology Department
    a. Strategic Management
    b. Decision Making, conflict and stress management
    c. Managing Change and Innovation
    d. Understanding Groups and Teams
    e. Leadership
    f. Time Management
    g. Cost and efficiency

Paper-2 Title : Modern Imaging Techniques including Fusion and hybrid imaging technologies (Theory: 60 hours/ 4 credits)

1. Interventional Radiography: Basic angiography and DSA:
    a. History , technique, patient care
    b. Percutaneous catherisation, catheterization sites, Asepsis
    c. Guidewire, catheters, pressure injectors, accessories
    d. Use of digital substraction- single plane and bi-plane

    All forms of diagnostic procedures including angiography, angioplasty, bilary examination,renal evaluation and drainage procedure.

2. Central Nervous System:
    a. Myelography.
    b. Cerebral studies.
    c. Ventriculography
3. Arthrography: Shoulder, Hip, Knee, Elbow
4. Angiography:
    a. Carotid Angiography (4 Vessel angiography).
    b. Thoracic and Arch Aortography.
    c. Selective studies: Renal, SMA, Coeliac axis.
    d. Vertebral angiography.
    e. Femoral arteriography.
    f. Angiocardiography.
5. Venography:
    a. Peripheral venography.
    b. Cerebral venography.
    c. Inferior and superior venocavography.
    d. Relevant visceral phlebography.

6. Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophyiology
7. Ultrasonography/ Doppler studies: Techniques of sonography-selection- Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities-

patient care and maintenance protocols clinical applications display methods –quality image reproducible extend – biopsy procedures, assurance to patients.

8. CT scan studies acquisition/ protocols /techniques: CT of head and neck – thorax – abdomen – pelvis – musculo skeletal system – spine – PNS. Anatomy – clinical indications and contraindications – patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.

9. MRI imaging – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation-positioning of the patient -patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI - image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures- reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI-role of radiographer.

10. Techniques of Fusion and hybrid Imaging Technology including PET CT,PET MRI, PET Ultrasound, MRI, CT, Fluoroscopy, Hybrid Imaging as well as Advanced Interventional suite.

Paper Title : Advanced Physics of Radiology & Imaging (Theory: 60 hours/ 4 credits)

1. Physics of Imaging including conventional radiography, computed radiography and flat panel DR imaging.

2. Computed Tomography- Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT-image display.

3. Advanced Computed Tomography -Helical CT scan: Slip ring technology, advantages, multi detector array helical CT, cone – beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose Index.

4. MRI- Basic Principles: Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image.
    a. Pulse sequence : Spin echo pulse sequence – turbo spin echo pulse sequence -

Gradient echo sequence – Turbo gradient echo pulse sequence - Inversion recovery sequence – STIR sequence – SPIR sequence – FLAIR sequence – Echo planar imaging – Advanced pulse sequences

b. MR Instrumentation: Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers.
c. Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP.
d. MR Spectroscopy – functional MRI

5. Ultrasonography

Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity.

Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing.Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam.
Ultrasound display modes: A, B, M

Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, andDistance, area & volume measurements.
Doppler Ultrasound, Doppler artifacts, vascular sonography

During clinical postings the professional is expected to work and contribute in the medical imaging unit.

Department level subjects

BIOMEDICAL WASTE MANAGEMENT (DSE-01)

Course Objective:

The student should be made to:

- Understand the hazardous materials used in hospital and its impact on health
- Understand various waste disposal procedures and management.

Unit I

For complete syllabus and results, class timetable and more pls download iStudy. Its a light weight, easy to use, no images, no pdfs platform to make students life easier.

Unit II

Biomedical Waste Management
Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste, Categories and classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labeling, waste handling, collection, storage and transportation, treatment and disposal.

Unit III

Hazardous Materials
Hazardous Materials : Hazardous Substance Safety, OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

Unit IV

Unit V

Infection Control, Prevention and Patient Safety
Healthcare Immunizations, Centers for Disease Control and Prevention, Disinfectants, Sterilants, and Antiseptics, OSHA Bloodborne Pathogens Standard, Tuberculosis, Healthcare Opportunistic Infections, Medical Waste. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures, Patient-Centered Healthcare, Quality Improvement Tools and Strategies,
Healthcare-Associated Infections, Medication Safety.

Unit VI

Infection control methods

Course Outcome:

At the end of the course, the student should be able to

- Analyse various hazards, accidents and its control
- Design waste disposal procedures for different bio wastes
- Categories different bio wastes based on its properties
- Design different safety facility in hospitals
- Propose various regulations and safety norms

Text Books:

1. Tweedy, James T., Healthcare hazard control and safety management-CRC Press_Taylor and Francis (2014).
2. Anantpreet Singh, Sukhjit Kaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd (2012).

References:

1. R.C. Goyal, Hospital Administration and Human Resource Management, PHI – Fourth Edition, 2006
2. V.J. Landrum, Medical Waste Management and disposal, Elsevier, 1991

SEMESTER I

HEALTH CARE EDUCATION TECHNOLOGY

Theory: 40 hours

Objectives:

At the end of the second semester students should be able to

- Document of learner behaviour and outcomes.
- Describe the application of technology to healthcare education, with examples of uses.
- Evaluate the application of innovative strategies to health care education.
- Identify resources available to educators to use and implement technology and innovative strategies in teaching.

Unit- I — 15 hours

- Educational Technology
  - State the meaning of educational technology
  - Define educational technology
  - Narrate the nature and characteristics of educational technology
  - Recognize the scope of educational technology
  - Explain the functions of educational technology
  - Appreciate the division and sources of educational technology
  - Appreciate the contribution of educational technology
- Interpersonal Relations
  - Define therapeutic communication
  - Describe the development of interpersonal relationship
  - State the dimensions of interpersonal relationship
  - Explain the phases of interpersonal relationship
  - Appreciate cultural influences in therapeutic relationship
  - Relate the role of transactional analysis with interpersonal communication

Unit- 2 — 15 hours

- Educational Objectives
  - Define educational objectives
  - State the purposes of educational objectives
  - Appreciate the data sources for formulation of educational objectives
  - List the characteristics of educational objectives
  - Identify types of educational objectives
  - Explain selection and statement of objectives
  - Categorize behavioural changes
- Health care careers
- Health Care Systems
- Careers in Health Care
- Personal and Professional Qualities of a Health Care Worker
- Legal and Ethical Responsibilities

- Basics of health care
- Promotion of Safety
- Infection Control
- Vital Signs
- First Aid

Unit- 3 20 hours

- Methods of Clinical Teaching
- Write philosophy of clinical teaching
- Realize the outcomes of clinical teaching
- Describe clinical teaching models
- Identify factors influencing clinical teaching
- State the purposes of clinical teaching
- Enumerate the preparation and execution of clinical teaching session and apply
- in their practice
- Explain case method and perform in clinical practice
- Outline the steps involved in process recording and apply in practice
- Recognize patient care assignment as a method of clinical teaching
- Information, Education and Communication for Health
- Define health education.
- Recognize the scope of health education.
- Narrate the aims and objectives of health education.
- Describe the models of health education.
- Explain the principles of health education.
- Specify patient education and their goals.
- Enumerate on patient education process.
- Identify the strategies of communicating health messages.
- Describe health communication.
-

Recommended books:

- Educational Technologies in Medical and Health Sciences Education Editors: Bridges, Susan, Chan, Lap Ki, Hmelo-Silver, Cindy E. (Eds.)
- Nursing Communication and Educational Technologyby R Pramilaa

SEMESTER 2

Paper title: Radiation Safety and Protection – AERB Guidelines (60 hours /4 credits)

Radiation safety in diagnostic Radiology

1. Introduction to Radiation protection-Need for protection, Aim of radiation protection.
2. Limits for radiation exposure: Concept of ALARA, maximum permissible dose, exposure in pregnancy, children. Occupational Exposure Limits - Dose limits to public
3. Radiation Protection in: Radiography, Fluoroscopy, Mammography, Mobile Radiography, CT scan, DSA and Interventional Radiology.
4. Radiation measuring instruments: survey meters, area monitor, personnel dosimeters, film badge, thermo luminescent dosimeter, pocket dosimeter.
5. Radiation Quantities and Units: Radiation, Radioactivity, Sources of radiation - natural radioactive sources, cosmic rays, terrestrial radiation, manmade radiation sources. Kerma, Exposure, Absorbed dose, Equivalent Dose, Weighting Factors, Effective Dose

6. Biological Effects of radiation: Direct & Indirect actions of radiation ,concept of detriment ,Deterministic & stochastic effect of radiation ,somatic and genetic effects, dose relationship , effects of antenatal exposure Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system includingfetus -Somatic effects and hereditary effects- stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radio sensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.

7. Radiation detection and Measurements: Ionization of gases, Fluorescence and Phosphorescence, Effects on photographic emulsion. Ionization Chambers, proportional counters, G.M counters, scintillation detectors, liquid semiconductor detectors, Gamma ray spectrometer. Measuring systems: free air ionization chamber, thimble ion chamber, condenser chamber, Secondary standard dosimeters, film dosimeter, chemical dosimeter- thermo luminescent Dosimeter, Pocket dosimeter, Radiation survey meter- wide range survey meter, zone monitor, contamination monitor -their principle function and uses. Advantages & disadvantages of various detectors & appropriateness of different detectors for different type of radiation measurement.

8. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD in mammography.

9. Radiation protection, Hazard evaluation and control:: Philosophy of Radiation protection Radiation protection of self and patient and General Public, Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey, Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology.

10. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding materials Protection for primary radiation, work load, use factor, occupancy factor, protection from scatter radiation and leakage radiation, X-Ray/Fluoroscopy/Mammography/Intervention/DSA/CT room design, structural shielding, protective devices.

11. Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements. (ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection).

12. NABH guidelines, AERB guidelines, PNDT Act and guidelines.
13. Procedural safety
14. Achievable safety through compliance on the regulations in India and recommendations of ICRT, IAEA.

Newer Radiation safety protocols and recent advances in radiation safety.

Role of Radiographer in Planning & Radiation Protection: Role of technologist in radiology department - Personnel and area monitoring., Setting up of a new X-Ray unit, staff requirement, AERB specifications for site planning and mandatory guidelines – Planning of X-ray/CT rooms, Inspection of X-Ray installations - Registration of X-Ray equipment installation- Certification -Evaluation of workload versus radiation factors – Occupationalexposure and protection Tools/devices.

Semester –II Paper title : Modern Radiological and Imaging Equipment (60 hours /4 credits)

1. High Frequency X-Ray Generators and their types and applications.
2. Modern x-ray tubes-their types and advancements.
3. Special radiological equipment: Computed radiography: its principle, physics & equipment. Digital Radiography, Direct and indirect digital radiography Digital Fluoroscopy , Digital Mammography; including cones compression devices Stereotactic Biopsy system including Prone Table Biopsy system.
4. Image Receptors: Flat Panel Detectors, Image Processing Workstation and Imaging Cameras.
5. Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of topographic movements,
6. Tomosynthesis, Stitch radiography
7. Dual energy x-ray absorptionometry (DEXA) scan.
8. Vascular Imaging Equipment: Introduction, historical developments DSA Equipment-Principle, applications and definition of terms, Single Plane, Biplane, Hybrid DSA Lab-digital subtraction techniques.
9. Scatter radiation its formation and control: beam centering devices, collimators, cone diaphragms and grids.
10. Fluoroscopy and IITV systems including cine radiography with various recording devices.
11. Computed Tomography -Principle, data acquisition concepts, image reconstruction, instrumentations, image manipulation Historical developments - Various generations, spiral/helical, single slice/multislice CT, Electron beam CT, mobile CT, Advances in volume scanning, continuous, sub-second scanning. Real time CT fluoroscopy, interventional guidance tool, 3D CT, CT angiography. Virtual reality imaging, including image quality and quality control in CT Scanners.
12. Ultrasonography: :Basic principle of U.S., various types of transducers, mechanism of image formation, various advancements including Doppler, Elastography, HIFU,ABVS and image artifacts.
13. MRI: Basic principle of MRI, complete imaging equipment and various requirements, T1 and T2 Relaxation behaviors of tissues, T1, T2 and proton density images, spatial localization of images. Types of imaging sequences (spin echo, fast spin echo, flash, inversion recovery, gradient echo etc. MR spectroscopy, principle and techniques, Contrast Agents in MRI, Image quality, Image artifacts and its compensators, NMR hazard and safety. Advances in MRI.
14. Radionuclide scanning including rectilinear scanner, gamma camera, PET, SPECT, their principles, working, applications and advancements.
15. Care and maintenance of radiological equipments

Semester II : Paper title: Radiological and Imaging Procedures (60 hours /4 credits)

1. Special Radiographic/Radiological procedures
2. Selection of Fluoroscopy Equipment, general considerations, responsibility of radiographers. Patient Preparation, Indications Contraindications Technique Post Care and Preparation of Drug Trolley/Tray, Radiation Safety. Contrast Media - Positive and Negative, Ionic & Non – Ionic, Adverse Reactions To Contrast Media and Patient Management, Emergency Drugs in the Radiology Department ,Aseptic technique for the following procedures.
3. Gastrointestinal Tract: Barium swallow, pharynx and oesophagus. Barium meal and follow through. Hypotonic duodenography. Small bowel enema. Barium Enema routine projections for colon and rectum, colonic activators; double contrast studies; colostomy. Special techniques for specific disease to be examined. Including water soluble contrast media - e.g. gastrograffin studies. Including CT, US and MRI Special Imaging Techniques.
4. Salivary glands: Routine technique, procedure - sialography.
5. Biliary system: Plain film radiography. Intravenous cholangiography. Percutaneous cholangiography, Endoscopic retrograde cholangio- pancreatography (ERCP). Operative cholangiography, Post-Operative cholangiography (T-tube Cholangiography). Including CT, US and MRI Special Imaging Techniques.
6. Urinary system: Intravenous urography, retrograde pyelography. Antegrade pyelography. Cystography and micturating cystouresthrography. Urethrography (ascending) renal puncture. Including CT, US and MRI Special Imaging Techniques.
7. Reproductive system: All the Techniques relating to Male and Female reproductive system including Hysterosalpingography.
8. Breast Imaging: Mammography: Basic views, special views, wire localization. Ductography, Tomosynthesis, ABVS, Various Biopsy Techniques including Prone Table Biopsy, CT, US and MRI Special Imaging Techniques
9. Respiratory system: - Bronchography: Including CT, US and MRI Special Imaging Techniques.
10. Sinography: Routine technique and procedure.
11. Central Nervous System: Myelography. Cerebral studies. Ventriculography etc. including CT, US and MRI Special Imaging Techniques.
12. Arthrography: Shoulder, Hip, Knee, Elbow joints etc. including CT, US and MRI Special Imaging Techniques.
13. Angiographic Studies: Carotid Angiography (4 Vessel angiography). Thoracic and Arch Aortography. Selective studies: Renal, SMA, Coeliac axis. Vertebral angiography. Femoral arteriography. Angiocardiography, Peripheral angiography
14. Venography: Peripheral venography. Cerebral venography. Inferior and superior venocavography. Relevant visceral phlebography.

15. Microbiology: Introduction and morphology - Introduction of microbiology, Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria. Growth and nutrition -nutrition, culture media, types

of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test Sterilization and disinfection - principles and use of equipments of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization, anti-septic and disinfectants. Introduction to immunology, bacteriology, parasitology, mycology

SEMESTER II

Department level subjects

RESEARCH METHODOLOGY AND BIOSTATISTICS (60 hours /4 credits)

Objectives: At the end of the semester students should be able to

1. Understand and apply statistical methods for the design of biomedical research and analysis of biomedical research data;
2. Learn to participate in a research team in study design, data coordination and management, and statistical analysis and reporting of study results

COURSE OUTCOMES:

At the end of the course students will be able to...

CO1: Identify different types of data and ways of presenting the data

CO2: Describe various measures of central tendency and dispersion

CO3: Understand the basic concept of probability distributions- Normal distribution,Binomial distribution, Poisson distribution

CO4: Identify and apply different sampling techniques

CO5: Differentiate structure of research protocol and thesis

CO6: Calculate the sample size for estimating means, proportions, testing of means,proportions between two groups

CO7: Identify different statistical tests and when to apply it

Unit 1: **15 hours**

Introduction

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

Unit 2: **10 hours**

Sampling

Random and non-random sampling, Different sampling techniques – simple random, stratified, systematic, cluster& multi-stage. Sampling and non-sampling errors and methodsof minimizing these errors

Unit 3: **10 hours**

Sampling distribution. Statistics and parameter. Standard error. Basic probability distributions-Normal, Poisson and Binomial distributions with their application in biological sciences. Skewness & Kurtosis.

Unit 4: **15 hours**

Tests of significance

Basics of testing of hypothesis – Null & Alternative hypothesis, type 1 and type II errors, level of significance & power of the tests, p value. Different Parametric Tests – T test (paired & unpaired), & Test for proportion, One way analysis of variance. Repeated measures analysis of variance. Non-
Parametric Tests of significance Chi square test– Mann

– Whitney U Test, Wilcoxon Test, Kruskal – Wallis Analysis of variance by ranks, Friedman's test.

Unit 5: **10 hours**

Correlation and regression

Linear correlation by Karl Pearson and Rank order correlation due to Spearman. Testingthe significance of correlation. Linear and Multiple regression.

Unit 6: **4 hours**

Sample size determination

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

Unit 7: **8 hours**

Study designs

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: **6 hours**

Multivariate analysis

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

Unit 9: **4 hours**

Reliability and validity of diagnostic tests

Unit 10: **8 hours**

Scientific documentations

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

References books:

1. ABC of research methodology and applied biostatistics by MN Parick & NithyaGogtay.
2. Introduction to biostatistics and research methods by P.S.S. Sundar Rao & J. Richard
3. Research methodology & Biostatistics- A comprehensive guide for health care professionals-Suresh K. Sharma
4. Guide to research methodology and Biostatistics-KMK Masthan

Syllabus

Subject: Constitution of India

Teaching hours 30

Unit-I: Meaning of the term 'Constitution'. Making of the Indian Constitution 1946-1950. (**1 hr)**

Unit-II: The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States. (**4 hrs)**

Unit-III: Fundamental Rights and Duties their content and significance. (**5 hrs)**

Unit – IV: Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles. (**5 hrs)**

Unit – V: Special Rights created in the Constitution for: Dalits, Backwards, Women and Children and the Religious and Linguistic Minorities. (**3 hrs)**

Unit-VI: Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India. (**3 hrs)**

Unit – VII: The Election Commission and State Public Service commissions (**2 hrs)**

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Unit – VIII: Method of amending the Constitution. (**3 hrs)**

Unit – IX: Enforcing rights through Writs: (**2 hrs)**

Unit – X: Constitution and Sustainable Development in India. (**2 hrs)**

References:

1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.
2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin: The Indian Constitution – Corner Stone of a Nation-Oxford, New Delhi, 2000.

SEMESTER III

Paper title:

Quality Assurance and Quality Control in Diagnostic Radiology and Imaging

1. Objectives of Quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance.
2. Quality Assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance.
3. Quality assurance programme in the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography; Computed tomography; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging- image distortion for digital imaging devices. LASER printer calibration

4. Quality assurance programme tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. Basic concepts of quality assurance – LASER printer - Light beam alignment; X-ray out-put and beam quality check; KVp check; Focal spot size and angle measurement; Timer check; mAs test; Grid alignment test; High and low contrast resolutions; Mechanical and electrical checks; Cassette leak check; Proper screen-film contact test; Safe light test; Radiation proof test; Field alignment test for fluoroscopic device; Resolution test; Phantom measurements - CT, US and MRI.
5. Quality assurance of film and image recording devices: Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion; Artifacts of films and image recording. Monitor calibration. SMPTE pattern.
6. Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.
7. Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.
8. Quality Assurance and quality control of Modern Radiological and Imaging Equipment which includes Digital Radiography, Computed Radiography, CT scan, MRI Scan, Ultrasonography and PACS related. Image artifacts their different types, causes and remedies

Semester III

Paper title:

Newer Imaging Modalities

1. Basic Computed Tomography- Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT image display

2. Advanced Computed Tomography - Helical CT scan: Slip ring technology, advantages, multi detector array helical CT, cone – beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose, patient preparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography – (Aortogram, selective angiogram head, neck and peripheral) image documentation and Filing, maintenance of equipment and accessories.

3. Advanced technique & instrumentation of MRI
4. Basic Principle: Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2

weighted image – proton density image.

5. Pulse sequence : Spin echo pulse sequence – turbo spin echo pulse sequence - Gradient echo sequence – Turbo gradient echo pulse sequence - Inversion recovery sequence – STIR sequence – SPIR sequence – FLAIR sequence – Echo planar imaging – Advanced pulse sequences.
6. MR Instrumentation: Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers.
7. Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP.
8. MR contrast media – MR angiography – TOF & PCA – MR Spectroscopy – functional MRI Ultrasonography
   Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity.
   Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing.
9. Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam.
10. Ultrasound display modes: A, B, M
11. Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements.
12. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety.
13. Doppler Ultrasound- Patient preparation for Doppler, Doppler artifacts, vascular sonography,
14. Elastography, HIFU, ABVS etc.
15. Fusion Imaging -PET CT & PET MRI

Paper title

Radiological Techniques and Care of Patient

1. Basic Angiography and DSA:
   History , technique, patient care, Percutaneous catherisation, catheterization sites, Asepsis ,Guide wire, catheters, pressure injectors, accessories, Use of digital substraction-single plane and bi-plane. All forms of diagnostic procedures including angiography, angioplasty, biliary examination, renal evaluation and drainage procedure and aspiration cytology under flouro, CT, US, MRI guidance.
2. Central Nervous System: Myelography. Cerebral studies, Ventriculography.
3. Arthrography: Shoulder, Hip, Knee, Elbow
4. Angiography: Carotid Angiography (4 Vessel angiography).Thoracic and Arch Aortography. Vertebral angiography, femoral arteriography. Selective studies: Renal, SMA, Coeliac axis. Angiocardiography.
5. Venography: Peripheral venography, Cerebral venography, Inferior and superior venocavography. Relevant visceral phlebography.
6. Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker.
7. Microbiology Introduction and morphology - Introduction of microbiology, Classification

of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria. Growth and nutrition -nutrition, culture media, types of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test. Sterilization and disinfection - principles and use of equipments of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization, anti-septic and disinfectants.

Care of Patient in Interventional Radiology

1. Introduction to patient care: responsibilities of healthcare facility-responsibilities of the imaging technologist.
2. General patient care, patient transfer technique-restraint techniques-aspects of patient comfort-specific patient conditions-security of patient property-obtaining vital signs-layingup a sterile trolley-assisting in IV injection.
3. Surgical Asepsis: The Environment and Surgical Asepsis, Methods of Sterilization, Disinfection, Opening Sterile Packs, Changing Dressing.
4. 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 department
5. Patient care during investigation: GI tract, biliary tract, respiratory tract, Gynecology, cardiovascular lymphatic system, CNS etc.
6. Infection control: definitions- isolation techniques-infection sources-transmission modes-procedures-psychological considerations – sterilization & sterile techniques.
7. Patient education: communication – patient communication problems – explanation of examinations-radiation safety/protection – interacting with terminally ill patient.
8. Medical Emergencies: Shock, Pulmonary Embolus, Diabetic Emergencies, RespiratoryFailure, Cardiac Failure, Airway Obstruction, Stroke, Fainting, Seizures.
9. Drug Administration: System of Drug Administration, Medication Error and Documentation, Equipment for Drug Administration, Methods of Drug Administration,Care of patient with Intravenous Infusions

SEMESTER-IV
Paper title:
Newer Developments in Advanced Imaging Technology and Biostatics.

1. In addition to existing Radiological and Imaging Modalities -Newer Developments in Digital Imaging CT,MRI,US and any other modality.
2. Newer Radiological and Imaging Equipment: including Computed radiography: Digital Radiography, Digital Fluoroscopy, Digital Mammography and DSA - Introduction to Newer Technology innovations, software and its applications.
3. Computed Tomography Introduction to Newer Developments/ Newer Technology innovations, software and its applications.
4. MRI Introduction to Newer Developments/Newer Technology innovations, software and its applications.
5. Advanced Ultrasonography Newer Developments/Newer, Technology innovations, software and its applications. Elastography, HIFU, ABVS etc.
6. Maxillo-facial imaging, dental radiology including RGV, OPG, CBCT and other advanced modalities
7. Tele-radiology, HIS, RIS, PACS, Imaging processing and archiving.

Biostatistics & Basic Research Methodology

1. What is statistics – importance of statistics in behaviors sciences- descriptive statistics and inferential statistics-usefulness of qualification in behavioral sciences – scales of measurements- nominal, ordinal, interval and ratio scales.
2. Data collection – classification of data-class intervals – continuous and discrete measurements-drawing frequency polygon-histogram-cumulative frequency curve-ogives-drawing inference from graph.
3. Measures of central tendency- need-types: mean, median, mode – working out these measures with illustrations. Measures of variability – need- types range, quartile deviation, average deviation, standard deviation, variance-interpretation.
4. Normal distribution-general properties of normal distribution-theory of probability-illustration of normal distribution-area under the normal probability curve. Variants from the normal distribution-skewness-quantitative measurements of skewness-kurtosis-measurements of kurtosis-factors contributing for non-normal distribution
5. Correlation-historical contribution-meaning of correlation-types: rank correlation, regression analysis.
6. Tests of significance- need for-significance of the mean-sampling error-significance of differences between means-interpretation of probability levels-small samples-large samples-inferential statistics-parametric and non-parametric methods-elements of multivariate analysis

Seminars, Journal Clubs and Group Discussions

Each student will be assigned topics for presentations as seminars, will explore recent innovations inMRIT for presenting topics during journal clubs and shall be holding group discussions along with other students in the presence of MRIT faculty. This will also include visits to other Institutions, Factories or Industries in the field of MRIT.

Skills based outcomes and monitorable indicators for Senior Medical Radiology andImaging Technologist (Sr. MRIT)

Competency statements

1. Demonstrate knowledge to interpret and evaluate a prescription
2. Communicates relevant information to other members and completes accurate documentation
3. Demonstrates knowledge of accurate position and ability to position all patients as per instructions
4. Recognize contrast induced adverse reactions
5. Collate and communicate health information
6. Operate and oversee operation of radiologic equipment
7. Maintain a safe, healthy and secure environment
8. Demonstrates ability to carry out the daily organization of the medical imaging unit
9. Demonstrates ability to interpret, apply and disseminate information as a member of the radiotherapy team
10. Demonstrates professional behavior
11. Demonstrates a sensitive and caring attitude towards the patient
12. Demonstrates ability to prepare the patient for the procedures.
13. Demonstrates ability to carry out the necessary data transfer checks
14. Demonstrate the ability to process and produce good quality radiographic mages.
15. Demonstrates ability to carry out treatment verification
16. Demonstrates ability to carry out corrective actions as per instructions
17. Demonstrates knowledge to check the dosage
18. Implements health and safety procedures
19. Demonstrates ability to interpret, apply and disseminate information as a member of the radiotherapy team
20. Ensures radiation protection legislation is adhered to
21. Demonstrates knowledge and skills to carry out the daily/weekly Quality Control (QC)checks
22. Participates in research activities

Fundamental Competencies	Applies fundamental competencies in the performance of tasks assigned.
Safe Work Practices	Conducts professional practice according to established protocols, safety guidelines and existing legislation.
Communication and Interactions	Interacts in a professional and competent manner, using effective listening, verbal and written communication in dealing with laboratory colleagues, patients, clients and other health professionals.
Film Processing	Perform X-ray film / image processing techniques (including dark room techniques)
Quality Assurance	Follows quality assurance policies and procedures and participants in quality assurance initiatives.
Communication	Collate and Communicate Health Information within and between the departments. Make decisions on information to be communicated based on needs of the individual and various regulations and guidelines
Professionalism	Meets the legal and ethical requirements of practice and protect the patient's right to an established standard of care. Professional responsibility encompasses scope of practice, accountability, and professional development.
Practical Skills	Able to Operate and oversee operation of radiologic equipment, To be able to process radiographic images and prepare and document reports, Recognise contrast induced adverse reactions Collate and communicate health information Ensure availability of medical and diagnostic supplies Maintain a safe, healthy and secure environment Making sure that the radiation safety guidelines are followed Making sure that biomedical waste disposal protocols are followed Making sure that the infection control policies andprocedures are followed Monitor and assure quality.

DSE – 02 Medical Law and Ethics 40 hours

Introduction to medical Law and ethics:

Introduction to Code of conduct, Basic principles of medical ethics Confidentiality, Malpractice and negligence - Rational and irrational drug therapy, Autonomy and informed consent - Right of patients, Care of the terminally ill- Euthanasia,

Organ transplantation, Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records – Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records.

Professional Indemnity insurance policy, development of standardized protocol to avoid near miss or sentinel events. Obtaining an informed consent. Consideration of medical ethics – Doctors, patient and profession.

CYBER SECURITY

Program Educational Objectives (PEOs)

The exposure of the students to Cyber Security program at Graduate and Post Graduate level should lead to the following: -

(a) Learn the foundations of Cyber security and threat landscape.

(b) To equip students with the technical knowledge and skills needed to protect and defend against cyber threats.

(c) To develop skills in students that can help them plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets.

(d) To expose students to governance, regulatory, legal, economic, environmental,

social and ethical contexts of cyber security.

(e) To expose students to responsible use of online social media networks.

(f) To systematically educate the necessity to understand the impact of cybercrimes and threats with solutions in a global and societal context.

(g) To select suitable ethical principles and commit to professional responsibilities and human values and contribute value and wealth for the benefit of the society.

Program Specific Outcomes (PSOs)

Upon completion of the degree program, students will be able to:-

(h) Understand the cyber security threat landscape.

(i) Develop a deeper understanding and familiarity with various types of cyber-attacks, cybercrimes, vulnerabilities and remedies thereto.

(j) Analyse and evaluate existing legal framework and laws on cyber security.

(k) Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds.

(l) Analyse and evaluate the importance of personal data its privacy and security.

(m) Analyse and evaluate the security aspects of social media platforms and ethical aspects associated with use of social media.

(n) Analyse and evaluate the cyber security risks.

(o) Based on the Risk assessment, plan suitable security controls , audit and compliance.

(p) Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.

(q) Increase awareness about cyber-attack vectors and safety against cyber-frauds.

(r) Take measures for self-cyber-protection as well as societal cyber-protection.

Syllabus of Cyber Security Program at Post Graduate Level

1. The syllabus for Cyber Security Program at Post Graduate Level is as under: -

Cyber Security Program at Post Graduate Level			
Module	**Module Name**	**Module Contents**	**Learning Outcome**
Module-I	Overview of Cybersecurity	Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies.	Students after completing this module will be able to understand the basic terminologies related to cyber security and current cyber security threat landscape. Theywill also develop understanding about the Cyber warfareand necessity to strengthen the cybersecurity of end user machine, critical IT and national criticalinfrastructure.
Module-II	Cyber crimes	Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cyber- squatting, Pharming, Cyber espionage, Cryptojacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake newscyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.	After completion of the module, students will have complete understanding of the cyber- attacks that target computers, mobiles and persons. They will also develop understanding about the type and nature of cyber crimes and as to how report these crimes through the prescribed legal and Government channels.
Practical	1. Platforms for reporting cyber crimes. 2. Checklist for reporting cyber crimes online.		

Cyber Security Program at Post Graduate Level			
Module	**Module Name**	**Module Contents**	**Learning Outcome**
Module-III	Cyber Law	Cyber crime and legal landscape around the world, IT Act,2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments,	Students after completing thismodule will be able to understand the legal framework that exist

		Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies.	in India for cyber crimes and penalties and punishments for such crimes, It will also expose students to limitations of existing IT Act,2000 legal framework that is followed in other countries and legal and ethical aspects related to new technologies.
Module IV	Data Privacy and Data Security	Defining data, meta-data, big data, non- personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues.	After completing this module, students will understand the aspects related to personal data privacy and security. They will also get insight into the Data Protection Bill,2019 and data privacy and securityissues related to Social media platforms.
Practical	1. Setting privacy settings on social media platforms. 2. Do's and Don'ts for posting content on Social media platforms. 3. Registering complaints on a Social media platform.		

Cyber Security Program at Post Graduate Level			
Module	**Module Name**	**Module Contents**	**Learning Outcome**
Module V	Cyber security Management, Compliance and Governance	Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.	Students after completing this module will understand the main components of cyber security plan. They will also get insights into risk- based assessment, requirement of security controls and need for cyber security audit and compliance.
Practical	1. Prepare password policy for computer and mobile device. 2. List out security controls for computer and implement technical security controls inthe personal computer. 3. List out security controls for mobile phone and implement technical security controlsin the personal mobile phone. 4. Log into computer system as an administrator and check the security policies in the system.		
References	1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. 2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley. 3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. 4. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press. 5. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication. 6. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon,2nd Edition, Jones Bartlett Learning.		

Cyber security scheme of Program Postgraduate Level

Sl. No	**Course Title**	**Teaching Scheme at UG and PG Level**		
		L/T	P	C
1	Cyber Security	3	1	4

Semester IV Disaster Risk management (40 hours)

OBJECTIVES:

At the end of the fourth semester students should be able to

1. Understand the emergency/ disaster management cycle
2. Develop a basic knowledge of prevention, mitigation, preparedness, response and recovery in disaster
3. Have a basic understanding emergency management.
4. Resuscitation and triage skills

COURSE OUTCOMES:

At the end of the course students will be able to...

CO1: Set up and respond for the management of hospital disaster. **CO2:** Understand the basic knowledge to manage the emergencies. **CO3:** Participate in triage and trauma management.

CO4: Perform Basic Life Support and Advanced Cardiac Life Support.

Unit-1 12 hours

- Hospital disaster preparedness and response
  - Scope
  - Coordination and management
  - Planning, training
  - Information, communication and documentation
  - Medico legal concerns
  - Safety and security
  - Human resources
  - Triage
  - Post disaster recovery
  - Patient handling
  - Volunteer involvement and management
  - Coordination and collaboration with wider disaster preparedness initiatives

Unit-2 16 hours

- First aid for unconsciousness
  - Aims , principles & rules of first aid
  - First aid box
- Trauma management
  - Guidelines, protocols, initial assessment
  - Trauma management in emergency department
- Wound management in emergency practice
  - Management of internal and external bleeding
- Chemical injury
- Management of drowning
- Burn care
  - Prehospital treatment
  - Initial emergency department treatment
  - Airway and respiratory care
  - Fluid resuscitation
- Electrical injury management

- Pre hospital management
  - Basic life support
  - Further treatment and transfer

Unit-3 12 hours

Cardio pulmonary resuscitation

- Basic life support
  - Algorithm
  - Mouth to mouth ventilation
  - External cardiac compression
- ACLS
  - Defibrillation
  - Vascular access
  - Definitive airway
  - Foreign body obstruction
  - Drugs
- CPR in infants and children
- Complications of BLS

Books recommended:

1. Disaster management for health care professionals- Joshi Sonopant G

Distribution of Type, Number and marks of Questions for Various Subjects

THEORY

Subjects having maximum marks = 100			Total
Type of question	Number of questions	Marks for Each question	
Long Essay	02	20	40
Short Essay	06	10	60
	TOTAL		**100**

Note : Revised as per the Proceedings of the 36th meeting of the Academic Council held on 30th Sep 2020. and Proceedings of the 59th meeting of the Board of Management held on 9th Oct 2020.

-End-