SHRI GURU RAM RAI UNIVERSITY

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]

SYLLABUS FOR

Bachelor of Medical Radio Imaging Technology

With CO, PSO And PO Mapping

School of Paramedical Sciences

(W.E.F 2021-2022)

Bachelor of Medical Radio Imaging Technology

OUTCOME-BASED EDUCATION

Programme outcome (POs)
Students will be able to

PO 1	Develop basic knowledge of radiology and relationship between physics and imaging techniques.
PO2	Identify, understand, formulate and solve problems related to radiological equipment
PO3	Design and develop solutions in case of emergency condition during radiological examination.
PO4	Develop an understanding to conduct investigation of complex problems.
PO5	Apply the basic and advanced knowledge of hardware, software and applications of computers in health care systems. .
PO6	Develop an understanding to evaluate the factors affecting technical quality of images and various pathological conditions.
PO7	Develop an understanding of the impact of radiation on society..
PO8	Understand their ethical and legal responsibilities as a radiographer.
PO9	Understand the importance of team work while handling patients with drugs & equipments in general as well as in emergency situations.
PO10	Develop understanding of laws/provisions for radiation safety by various regulatory bodies.
PO11	Implement and follow standard protocols while doing various radiological procedures and scans.
PO12	Maintain quality assurance, quality control measures, safety procedures and maintenance of radiological equipments.

SHRI GURU RAM RAI UNIVERSITY DEHRADUN (UTTARAKHAND)

REGULATIONS OF THE UNIVERSITY FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE ON MEDICAL RADIO & IMAGING TECHNOLOGY

In exercise of the powers conferred by section of the SGRR University Act no.3 of 2017.Academic Council of the Shri Guru Ram Rai University Dehradun hereby makes the following regulations:-

SHORT TITLE AND COMMENCEMENT

(1) These regulations shall be called "THE REGULATIONS FOR THE BACHELOR OF SCIENCE IN MEDICAL RADIO & IMAGING TECHNOLOGY OF THE SHRI GURU RAM RAI UNIVERSITY, DEHRADUN".

(2) They shall come into force from the 2019-2020 academic sessions.

(3) The regulations framed are subject to modification from time to time by the sending them to the Academic Board of the University.

ADMISSION, SELECTION, MIGRATION AND TRAINING
ADMISSION TO THE B.Sc, MEDICAL RADIO & IMAGING TECHNOLOGY COURSE.

'ELIGIBILITY CRITERIA'

No Candidate shall be allowed to be admitted to the B.Sc Medical Radio Imaging Technology (BMRIT) until:-

1) He/She has completed the age of 17 years on or before first day of July of the year commencing the prescribed academic session of the said course;
2) He/She has passed qualifying examination as under:

a) The Indian school Certificate Examination which is equivalent to 10+2 Higher Secondary Examination after a period of 12 years study, the last two years study comprising of Physics, Chemistry, Biology or Mathematics or any other elective subject with English at a level not less than the core course for English as prescribed by the National Council for Educational Research and training after the introduction of the introduction of the 10+2+3 years educational structure as recommended by the National Committee on education;

OR

b) The Intermediate examination in science of an Indian University/Board or other recognized examing body with Physics, Chemistry, Biology /Maths which shall include a practical test in these subjects and also English as a compulsory subject.

OR

c) The pre-professional or medical examination with Physics, Chemistry and Biology after passing either the higher Secondary school examination, or the pre-university or an equivalent examination. The pre-professional/pre-medical examination shall include a practical test in physics, Chemistry and Biology/and also English as a compulsory subject.

OR

d) The first year of the three years degree course of recognized University, with Physics, Chemistry and Biology/ including a practical test in these subject provided the examination is a 'University Examination' and candidate has passed 10+2 with English at al level not less than a core course;

OR

e) B.Sc examination of an Indian University, provided that he/she has passed the B.Sc examination with not less than two of the following subjects-Physics, Chemistry (Botany, Zoology) and further that he/she has passed the earlier qualifying examination with the following subjects Physics, Chemistry/Biology and English (10+2 level);

OR

f) Any other examination which in scope and standard is found to be equivalent to the intermediate science examination of an Indian University/Board, taking Physics, Chemistry and Biology including a practical test in each of these subjects and English.

OR

10+2 with vocational training in Radiology/ Medical Microbiology/MLT/Diploma in Radiology/ Diploma in MLT are also eligible.

MIGRATION/TRANSFER OF CANDIDATE

a) Migration/ Transfer of candidate from one recognized institution to another institution of this University or from another University will not generally be considered.

b) However, under extra ordinary circumstances, the Vice –Chancellor shall have the power to place any migration/ transfer he deems fit I the Governing Council and get its approval for grant of permission for migration/ transfer to candidates to candidates undergoing course of study in affiliated institutes of this university.

TRAINING PERIOD AND TIME DISTRIBUTION

1) The course of BMRIT shall be Three and a Half academic years including 6 months compulsory internship. The practical training should be in a150 bedded hospital with minimum patients occupancy of 75%. A part from practical training in non-clinical subjects, the students shall also undergo practical training in the said hospital equipped with X-rays, Ultra Sound & CT Scan,MRI in Deptt. of Radiology of the said hospital.

2) The period of Three & a Half years is divide into phase as follows:-

(a) Phase 1 First year B.Sc Medical Radio & Imaging Technology (BMRIT) (One Year duration)

i) Human Anatomy **BMRT-101**

ii) Human Physiology **BMRT -102**

iii) Preventive Medicine and Health care **BMRT -103**

iv) Basic & Radiation Physics **BMRT -104**

v) Orientation of Diagnostic Radiology & Radiological Imaging **BMRT -105**

(b) Phase II- Second Year B.Sc Medical Radio & Imaging Technology (BMRIT) (One Year duration)

I. Orientation in Paraclinical Science. **BMRT -201**

II. Special radiological equipment and radiation protection. **BMRT -202**

III. Radiographic Techniques. **BMRT -203**

IV special radiological procedures **BMRT -204**

IV. Advanced technique & instrumentation of CT and MRI. **BMRT -205**

(c) Phase III- Third Year B.Sc Medical Radio Imaging Technology (BMRIT) (One Year Duration)

I. Orientation in Clinical Sciences. **BMRT -301**

II. Radiotherapy Planning & radiation therapy. **BMRT -302**

III. Equipments For Radiotherapy Including Newer Developments. **BMRT -303**

IV. Interventional Radiological Procedures and Techniques. **BMRT -304**

V. Patient Care and Radiation Protection in Diagnostic Radiology. **BMRT -305**

(d) Phase IV Six –months compulsory internship in a 150 bedded indoor hospital.

Compartments / Supplementary/ Back Paper:

(I) A student who obtain 40% of the marks individually Including Internal but has failed in two papers shall be permitted to appear in those papers only at the two consecutive examination and if he/she passes at either of those examination he/she will be deemed to have passed the examination and will be promoted to higher class. (Aggregate marks should be 50%).

(II) A student (s) appearing in back paper/ supplementary shall be
Eligible to join the next higher Class provisionally however any student who fails to pass Ist year would not be admitted in 3rd year course.

There shall be one main examination in a year and a supplementary to be held not less than 6 months after publication of its results.

Theory Examination: All the papers in each year carrying 100 marks out of which 30 marks will be internal assessment and 70 marks for external assessment based on the question paper sent by the University the paper will be 3 hrs. Each paper will have 8 questions out of which the candidate will have to attempt 5 questions.

The practical examination will be held with the Final Examination. The practical and Viva voice in each subject will carry 30% marks as internal & 70% marks as external assessment (according to examination scheme) prescribed for the year.

PHASE DISTRIBUTION AND TIMING OF EXAMINATION:

1. Ist Annual Examination at the end of Ist year.
2. 2nd Annual Examination at the end of 2nd year.
3. 3rd Annual Examination at the end of 3rd year.
4. Six months Internship after third Annual Examination.

EXAMINATION REGULATIONS

Essentialities for qualifying to appear in professional examinations. The performance in essential components of training to be assessed based on.

ATTENDANCE: 75% of attendance in a subject for appearing in the examination is compulsory provided he/she has 80% attendance in non-lecture teaching i.e. seminars group discussions. Practical in Hospital postings and bedside clinics of 150 bedded indoor hospital with at least 75% patient Occupancy.

INTERNAL ASSESSMENT:

(a) It shall be based on day today assessment (see note), evaluation of student assignment, preparation for seminar. Clinical case presentation etc.

(b) Sessional examinations shall be conducted throughout the course. The question of number of examinations is left to the institutions;

(c) Day to day records should be given importance during internal assessment.

(d) Weightage for the internal assessment shall be 20% marks of the total marks fixed for internal.

(e) Student must secure at least 50% marks of the total marks fixed for internal Assessment in Particular subject in order to eligible to appear in final university examination of the subject.

Note: Internal Assessment shall being different ways in which students participation in learning process is evaluated. Some examples are as follows-

(i) Preparation of subject for student's seminar.
(ii) Preparation of a clinical case for discussion.
(iii) Clinical case study problem solving exercise.
(iv) Participation in projects for health care in the community.
(v) Proficiency in carrying out a practical or a skill in small research project.
(vi) Multiple choice questions (MCQ) test after completion of a system/ teaching. Each item tested shall be objectively assessed and recorded. Some of the items can be assigned as home work'/Vacation work.

UNIVERSITY EXAMINATIONS:

Theory Papers will be prepared by examiners as prescribed. Nature of question will be short answer type / objective type and marks for each part indicated separately.
Practical/ clinical will be conducted in the laboratories or hospital wards. Objective will be to assess proficiency in skills Conduct of experiment, interpretation of date and logical conclusion. Clinical cases should preferably include common diseases not esoteric syndromes or rare disorders. Emphasis should be on candidate's capability in eliciting physical signs and their interpretation.

Viva/ oral includes evaluation of management approach and handling of emergencies Candidate's skills interpretation of common investigative data also is to be evaluated.

The examinations are to be designed with a view to ascertain whether the candidate has acquired the necessary for knowledge, skills along with clear concepts of the fundamentals, which are necessary for him to carry out his professional day to day work competently. Evaluation will be carried out on an objective basis and practical Question papers should preferably be of short structure/objective type.

Clinical cases/ practical shall take into account common diseases, which the student is likely to come in contact in practice.

During evaluation (both external and internal) it shall be ascertained if the candidate has acquired the skills.-

There shall be one main examination in a year and a supplementary to be held not less than 6 months after publication of its results.

Note: Result of all University Examinations shall be decided before the start of teaching for next session.

DURATION OF EXAMINATION & QUESTIONS

(i) Each written paper will be attempted.
(ii) A clinical / practical examination in any subject for student shall not be for more than a day.

GENERAL

If Candidate obtains an aggregate of 75% in all the subjects of any professional Examination, he will be declared to have passed that Examination with Honors, provided he/she passes in all subjects in the first attempt.

INTERNSHIP

General

Internship is a phase of training wherein a graduate is expected to conduct actual practice of Medical Radio Imaging & Technology and acquired skills under supervision so that he/she may become capable of functioning independently.

SPECIFIC OBJECTIVES

At the end of internship training the graduate shall be able to:

(i) Perform all the diagnostic techniques.

(ii) Use discretely the essential diagnostic services.

(iii) Manage all type of clinical diagnostic methods.

(iv) Demonstrate skills in handling the modern equipment in Medical Radio Imaging & Technology.

(v) Develop leadership qualities to function effectively as a reader of the Laboratory environment.

(vi) Render service of the Laboratory setup and to communicate effectively with the Doctors and the hospital management.

INTERNSHIP TIME DISTRIBUTION

Main Objective

Development of skills and competency in data processing, reporting and maintenance of records, Laboratory investigations.

Total Period of Internship: 6 Months

OTHER DETAILS

(1) All parts of internship shall be at least 150-bedded hospital & minimum patient occupancy in 75%.

(2) Every candidate will be required after passing the final B.Sc Medical Radio Imaging Technology, Examination to undergo compulsory rotatory internship to the satisfaction of the college Authorities and University concerned for a period of 6 months so as to be eligible for the award of the degree of Bachelor of Science in Medical Radio & Imaging Technology.

(3) The University shall issue a provisional B.Sc Pass Certificate on passing the final examination after the internship completion on demand by the candidate.

(4) The intern shall be entrusted with Laboratory responsibilities under direct Supervision of Senior Post graduate Radiologist & Ultrasonologist. They shall not be working independently.

(5) Interns will not issue certified reports or other related documents under their signature.

ASSESSMENT OF INTERNSHIP

(1) The interns maintain the record of work, which is to be verified and certified by the Post graduate Radiologist & Ultrasonologist under whom he/she works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation test in knowledge, skills and attitude during and at the end of training. Based on the record of work and date of evaluation the Director / Principal shall issue 'Certificate of Satisfactory Completion" of training following which the University shall award the B.Sc (MRIT) Degree and declare the candidate eligible for the same.

(2) Satisfactory completion shall be determined on the basis of the following:

(a) Proficiency of knowledge required for each Diagnostic Techniques

(b) The competency in skills expected to manage each Diagnostic Technique.

- Competency for performance of self –performance
- Of having assisted in procedures
- Of having observed.

(c) Responsibility, Punctuality, workup Diagnostic Techniques, involvement in procedures, follows of report.

(d) Capacity to work in a team (behavior with colleagues, nursing staff and relationship with Medical and Para medicals.

(e) Initiating, participation in discussions, research aptitude.

MEDIUM OF INSTRUCTION

English shall be the Medium of Instructions for all the subject of study and for examinations of Bachelor of Medical Radio Imaging Technology course.

WORKING DAYS IN AN ACADEMIC YEAR

Each Academic year shall spread over a period of not less than 180 working days.

CONDITION OF LACK OF ATTENDANCE

As per the existing rules and regulations of SGRR University, Dehradun

SUBMISSION OF RECORD NOTE BOOKS

At the time of practical examination, each candidate shall submit to the examination the record notebooks duly certified by the Head of the College as a bonafide record of work done by the candidate.

CLASSIFICATION OF SUCCESSFUL CANDIDATE

REVALUATION OF ANSWER PAPAERS

The regulations as prescribed by the University for other Undergraduate Course shall be applicable.

WARD OF MEDALS AND PRIZES

The University shall award at its convocation medals and prizes to outstanding candidates, as and when instituted by the donors as per the schedule as per the prescribed for the award.

UNIVERSITY RANKING

First, Second and third University ranks may be awarded to candidates, who have passed all the examination in the first appearance and taking into consideration the aggregate marks obtained in all the subjects in which the candidate had been examined during the entire course of study.

DISTRIBUTION OF PAPERS & MARKS IN VARIOUS YEARS

IST YEAR

Course Code	Course title	Marks for Theory			Marks for Practical			Total Marks
		IA*	EE*	Total	IA*	EE*	Total	
BMRT 101	Human Anatomy	30	70	100	30	70	100	200
BMRT 102	Human Physiology	30	70	100	30	70	100	200
BMRT 103	Preventive Medicine and Health Care	30	70	100	-	-	-	100
BMRT 104	Basic & Radiation Physics	30	70	100	-	-	-	100
BMRT 105	Orientation of Diagnostic Radiology & Radiological Imaging	30	70	100	30	70	100	200
	TOTAL	**150**	**350**	**500**	**90**	**210**	**300**	**800**

IIND YEAR

Course Code	Course title	Marks for Theory			Marks for Practical			Total Marks
		IA*	EE*	Total	IA*	EE*	Total	
BMRT 201	Orientation in Paraclinical Sciences	30	70	100	-	-	-	100
BMRT 202	special radiological equipment and radiation protection	30	70	100	30	70	100	200
BMRT 203	Radiographic Techniques	30	70	100	30	70	100	200
BMRT 204	special radiological procedures	30	70	100	30	70	100	200
BMRT 205	Advanced technique & instrumentation of CT and MRI	30	70	100	-	-	-	100
	TOTAL	**150**	**350**	**500**	**90**	**210**	**300**	**800**

IIIRD YEAR

Course code	Course title	Marks for Theory			Marks for Practical			Total Marks
		IA*	**EE***	**Total**	**IA***	**EE***	**Total**	
BMRT-301	Orientation in Clinical Sciences	30	70	100	-	-	-	100
BMRT-302	Radiotherapy Planning & radiation therapy	30	70	100	30	70	100	200
BMRT-303	Equipments For Radiotherapy Including Newer Developments	30	70	100	30	70	100	200
BMRT-304	Interventional Radiological Procedures and Techniques	30	70	100	30	70	100	200
BMRT-305	Patient Care and Radiation Protection in Diagnostic Radiology	30	70	100	-	-	-	100
	TOTAL	**150**	**350**	**500**	**90**	**210**	**300**	**800**

Note:

1. The minimum pass marks will be 40% in individual subjects in theory and Practical and 50% in aggregate.

2. The Theory and Practical papers will be of equal weightage with 30% in Sessional and 70% in final University Examination.

3. The division will be determined on the basis of the aggregate of the marks of all the courses./subjects prescribed for the degree as under:

   a) Passed with honors will be rewarded on 75% and above only in first attempt.

   b) First Division will be marked on 60% and above.

   c) Second Division will be marked on 50% and above but less than 60%.

Bachelor's in Medical Radio Imaging and Technology Ist year

Course code	**:**	BMRT-101
Course Name	**:**	Human Anatomy
Semester /Year	**:**	Ist Year

	L	T	P	C

UNIT-I

Introduction- Scope of Anatomy. Organization of Tissue. Organs and systems. Anatomical position of the body. Axis and planes.

Bones- Classification development, parts of long bones and blood supply of bones.

Joints- Definition, classification, movements of different joint.

UNIT-II

UPPER EXTREMITY

Osteology- Clavicle, scapula, Humerus, Radius, ulna, carpals, metacarpals and Phalanges

Soft tissue- (Only Outline) Breast, pectoral region, axilla, front & back of arm, front of forearm, back of forearm, Palm, dorsum aspect of Hand.

Joints- Shoulder girdle, Shoulder joint, elbow joint, radio-ulnar joint, wrist joint and joints of hand.

Surface measuring and Radiological Anatomy of upper limb.

UNIT –III

LOWER EXTREMITY

Osteology- Hipbone, Femur, Tibia, Fibula, Patella, Tarsals, Metarsals and Phalanges.

Soft tissue parts: Only outline.

Glutela region, front and back of the thigh (femoral triangle, femoral canal and inguinal canal) medial side of the thigh (adductor canal). Lateral side of the thigh, popliteal fossa, Anterior and posterior compartment of leg, sole of the foot.

Joints- Hip joint, knee joint, ankle joints of the foot.

Surface Anatomy and Radiological Anatomy of Lower Limb.

UNIT-IV

TRUNK

Osteology-Vertebra and ribs, sternum.

Soft tissue-Vertebral muscles & intercostals muscles

Joints- Costochondral, Costo vertebral, Intervertebral Joints.

HEAD AND NECK

Osteology- Mandible and bones of skull.

Joints- Temporo mandibular Joints.

Surface and Radiological Anatomy of the Head & Neck.

UNIT –V

THORAX

a) Pleura
b) Lungs
c) Mediastinum
d) Pericardium
e) Heart
f) Trachea
g) Oesophagus

Surface measuring and Radiological Anatomy of Thorax.

UNIT- VI

ABDOMEN

Soft Tissue- Only Outline

a) Abdominal cavity & Peritoneum
b) Stomach
c) Intestine
d) Spleen
e) Pancreas
f) Liver & Gall Bladder
g) Kidney & Ureter, Urinary Bladder & Urethra
h) Diaphgram
i) Male & Female reproductive organs.
j) Rectum & Anal Canal.

II- Surface measuring and Radiological Procedure Used in the study of Abdominal Organs.

NEURO ANATOMY

a) Meninges & C.S.F.
b) Sulcuss & Gyrus and various areas of Cerebral Hemispheres.
c) Thalamus, Hypothalamus and basal Ganglia.
d) Cerebellum.
e) Pons Medulla.
f) Spinal Cord.
g) IIIrd, IVth & Lateral Ventricles.
h) Blood Supply of Spinal Cord & Brain.

Surface and Radiological Anatomy of Brain.

PRACTICALS

a) Surface measuring
b) Ostiology.
c) Identification of Anatomical structures with help of models, charts, CD Rom etc.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To outline introduction of anatomy, classification and development of bones and joints.
CO2	To outline introduction of anatomy, classification and development of bones and

	joints.
CO3	To determine osteology and joints associated with lower limb of human body.
CO4	To illustrate osteology, soft tissues and joints associated with trunk, head and neck portion of body.
CO5	To assess organs present in thorax portion of the body like pleura, lungs, mediastinum, pericardium, heart, trachea and oesophagus.
CO6	To write about abdomen portion of the body and neuro anatomy

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	1	-	1	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	-	-	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	-
CO6	-	-	-	-	-	1	-	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Bachelor's in Medical Radio Imaging and Technology I[st] year

Course code	**:**	BMRT-102
Course Name.	**:**	Human Physiology
Semester /Year	**:**	I[st] Year

	L	T	P	C

UNIT-I
PHYSIOLOGY OF BLOOD AND CVS

a) Composition of Blood
b) Function of RBC WBC
c) BLOOD groups
d) Circulation-General Principles
e) Cardiac cycle and output
f) E.C.G.

UNIT-II
RESPIRATORY SYSTEM

a) Mechanism of respiration- internal and external.
b) Capacity and lung volumes.

DIGESTIVE SYSTEM

a) Introduction to digestive system, Alimentary functional anatomy
b) The Salivary glands
c) The stomach and its secretion
d) Intestine & its secretion
e) Function of liver

UNIT-III
ENDOCRINAL SYSTEM

General Principle of endocrinology
Thyroid
Parathyroid

SKIN

Structure & function of Skin.

UROGENITAL SYSTEM

Physiology of Kidney and Urine formation

a) Constituent of normal urine etc.
b) Kidney function tests
c) Physiology of Male and Female reproductive system.

UNIT-IV

a) Reflex arc.
b) Physiology of the central nervous system.
c) Physiology of the sympathetic and Parasympathetic nervous system.
d) Function of Cerebrum, Cerebellum, basal ganglia, thalamus
e) Hypothalamus, CSF and Blood brain barrier.

Practical's

TLC
DLC
RBC, Hb, E groups, cardiac cycle and E.C.G.
Blood Press
Reflexes- S
Test for fun
Test for fu

Course outcomes (COs):

CO1	To memorize physiology and composition of blood and CVS, blood
CO2	To summarize mechanism of respiration, capacity of lung volume, introduction of digestive system, functions of organs and glands associated with digestive system.
CO3	To determine general principle of endocrinology, structure and function of skin
CO4	To illustrate physiology of kidney and reproductive system, KFT and constituents of urine.
CO5	To review reflex arc, physiology of CNS, physiology of sympathetic and parasympathetic nervous system and to assess function of different parts

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

	of brain.
CO6	To facilitate experimental handling by doing TLC, DLC, RBC, Hb, ESR, BP etc. during lab sessions

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	3	-	-	1	-	-	-
CO2	-	-	1	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-	-	-	-	-
CO4	-	-	-	1	-	3	-	-	1	-	-	-
CO5	-	-	-	1	-	3	-	-	-	-	-	-
CO6	-	-	1	2	3	2	-	-	-	-	-	-

Bachelor's in Medical Radio Imaging and Technology Ist year

Course code	**:**	BMRT-103
Course Name	**:**	Preventive Medicine and Health Care
Semester /Year	**:**	Ist Year

	L	T	P	C

UNIT-I **Water, air, and noise Pollution:** Removal of water hardness, purification of water and standards of water quality. Air and Pollution and their prevention. Housing and air conditioning.
UNIT-II **Hygiene and sanitation:** Sanitation barriers, excreta disposal and disposal of hospital waste. Incineration and disinfection. **Infections and control:** Microbial Pathogenecity, source and spread of infection in community, pathogenesis, toxigenicity, invasiveness, variations and virulence, host factors controlling infections to men, mode of spread and their control by physical & chemical agents.
UNIT-III **Epidemiology:** Epidemiology, surveillance and control of community infections.. Emergence of drugs resistance. Methods of prevention and control-Isolation of patients, quarantine and incubation periods of various infectious diseases. **Prophylactic immunization:** Rationale of immunization, immune response and duration of immunity, controlled studies of prophylactic Vaccines and hazards immunization. Various national immunization programs and vaccine schedule. Reproductive, Family Planning & Child Health Care Programs.
UNIT- IV 1. Health care by balance diet and yoga: Normal constituents of diet, various diet programs, balanced diet and factors responsible for etiology of various nutritional disorders. Carcinogens in food, Role of regular exercise and yoga in prevention and management of various diseases. 2. Health Planning and Management: Health planning, Planning cycle, malaria eradication and various other national health policy and programs.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To outline about water, air and noise pollution
CO2	To associate with hygiene and sanitation.
CO3	To examine infection and control like microbial pathogenecity and source and spread of infection
CO4	To illustrate about epidemiology, surveillance, methods of prevention and control of infection.
CO5	To debate on prophylactic immunization.
CO6	To write about role of balanced diet and yoga for health care and health planning and management.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	2	-	-	-	-
CO2	-	-	-	-	-	2	2	1	-	-	-	-
CO3	-	-	-	-	-	3	1	-	-	-	-	1
CO4	-	-	-	-	-	3	1	1	1	-	-	-
CO5	-	-	-	-	-	2	1	-	-	-	-	-
CO6	-	-	-	-	-	1	2	-	-	-	-	-

Bachelor's in Medical Radio Imaging and Technology Ist year

Course code	**:**	BMRT-104
Course Name	**:**	Basic Physics
Semester /Year	**:**	Ist Year

	L	T	P	C

UNIT-I

Fundamental of Physics

Basic concepts: Basic Units, Heat. Basic concepts of power, work, force, energy. Units and measurements - temperature and heat-SI units of above parameters Atomic structure- Nucleus - Atomic Number, Mass Number electron orbit and energy levels-Periodic table -Isotopes-Isobars Ionization and excitation

Electromagnetic induction: Electric charges, Coulomb's law- electric potential capacitance and capacitors. Electrical energy and power - unit of current-resistance and Ohm's law - circuit laws - e.m.f. Magnetism-Magnetic effect of an electric current - applications of magnetic field. Electro-magnetic induction, Faradays laws, mutual induction and self induction. Alternating current-transformers theory and losses - practical aspects-reactance –resonance - impedance and power factors

Radioactivity: Natural and artificial radioactivity-alpha decay-beta decay and Gamma decay. Half life Nuclear Fission-Nuclear reactor. Radiation sources-Natural and artificial-production of radio isotopes-reactor produced isotopes Fission products-Gamma ray source for Medical uses.

UNIT-II

RADIATION PHYSICS

Production and Properties of X-ray.

Interaction of X-and Gamma rays: Attenuation of X-ray or Gamma rays- Absorption and scattering-half value layer, coherent scattering-Photo electric absorption-Compton scattering-pair production and photoelectric Disintegration**.**

Radiation Measurement and its units. Absorbed does & RAD

Radiation detector –TLD badge, Geiger Muller counter (GM counter), Scintillation detector, Pocket Dosimeter, Ionization chamber.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To define basic concepts of atomic structure, ionization, excitation, basic units and measurements.
CO2	To interpret practical aspects behind electromagnetic induction, capacitance, circuit laws, impedance and power factors.
CO3	To examine the phenomenon of Radioactive decay, production of radioisotopes and fission products.
CO4	To explain the process of radiation production and interpret properties of X- rays.
CO5	To debate on the interaction of radiation with matter and outline measurement units like absorbed dose & RAD.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	2	1	-	-	-	-	-	-
CO3	3	-	-	-	1	2	-	-	-	-	-	-
CO4	3	2	-	-	2	2	-	-	-	-	-	1
CO5	3	1	-	-	1	1	-	-	-	-	-	1
CO6	3	1	1	-	2	2	1	2	-	3	2	2

CO6	To write about measurement of radiation dose through different radiation detectors

Bachelor's in Medical Radio Imaging and Technology Ist year

Course code	**:**	BMRT-105
Course Name	**:**	Orientation of Diagnostic Radiology and Para clinical Imaging
Semester /Year	**:**	Ist Year

	L	T	P	C

UNIT-I

- The X-Ray machine: X-ray Tube design, Tube housing , Anode & Cathode, Types of Anode, Focal Spot Size, Principle of line Focus, Managing the Heat Produced by X-ray Tubes, Quality and Intensity of X-rays , Filtration, Tube Failure Causes,
- Circuit of X-ray Generator, Exposure timing.

UNIT-II

- Scattered Radiation, Beam limiting devices.- Grid principle and structure Types of Grids ,Stationary grid, parallel grid, focused grid, crossed grid, moving grid ,Bucky.
- Radiographic Film, Latent Image, Intensifying Screens, cassette.
- Radiographic Exposure, Film Developing & Processing, Dark room,
- Radiographic Image: Image clarity contract factor affecting contrast Image quality mottle sharpness and resolution and Noise. Magnification penumbra un sharpness inverse square law patient exposure.
- Lay out of X-ray room and dark room
- Cassette & Film Handling-Loading & Unloading, safe light.

PRACTICAL BASED ON THEORY

Study with charts, models & power point presentations Atomic structure, X-ray tubes, X-ray circuits involving students to present and discuss.

Upon successful completion of the course a student will be able to

Course outcomes (COs):

CO1	To Describe the use x-ray exposure switches
CO2	To classify the equipment maintenance of equipment procedure of X-ray machine and cooling method.
CO3	To determine general principle of endocrinology, structure and function of skin To Demonstrate work flow digital/equipment handling.
CO4	To assess the importance Of radiographic exposure.
CO5	To evaluate the radiographic image quality
CO6	To design the parameter for identification of radiographic image quality

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	2	-	-	-	-	-	-	1
CO2	2	2	2	-	2	1	1	1	-	1	-	3
CO3	2	2	-	-	2	1	-	-	-	-	-	1
CO4	1	1	2	-	-	-	-	-	-	-	1	-
CO5	1	-	-	-	1	3	-	-	-	-	-	-
CO6	1	-	-	-	1	3	-	-	-	-	-	-

Bachelor's in Medical Radio Imaging and Technology IInd year

Course code	**:**	BMRT-202
Course Name	**:**	Orientation in Para clinical Imaging
Semester /Year	**:**	IInd year

	L	T	P	C

UNIT-I

PARASITOLOGY

- Entamoeba Histolytica
- Leishmania
- Material Parasites of Man
- Helminthology
- Taenia Saginata
- Taenia Soleum
- Echinococcus Granulosvs
- Ascaris Lumbricoides
- Ancylostoma Duodenale
- Strongylids Stercoralis

UNIT-II

MICROBIOLOGY

- Morphology & physiology of Bacteria
- Staphylococcus
- Streptococcus
- Mycobacterium Tuberculosis
- Spirochetes
- Corneybacterium Diptheria

UNIT-III

VIRUS

- General Properties
- Herpes Virus
- Poliovirus
- Hepatitis Virus
- Oncogenic Virus
- HIV

UNIT-IV **PATHOLOGY** • Inflammation • Osteomyelitis • Fractures • Osteoporosis • Rickets • Osteomalacia • Tumors of Bone • Rhematoid Arthiritis • Gout • Osteoarthritis
UNIT-V **PHARMACOLOGY** Pharmacokinetics of Drugs - Absorption - Metabolism - Excretion Adverse drugs, reaction & its Management

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To outline about two different modalities of radiography i.e Fluoroscopy and mammography.
CO2	To done contrasting between computed and digital radiography
CO3	To examine physical characteristics of ultrasound and Doppler techniques.
CO4	To link between data communication in the radiology department and computers in radiology.
CO5	To comment on Tele radiology system and review various principles of radiation protection.
CO6	Create. design. compose. create. plan. To manage shielding materials, radiation survey meters and personnel monitoring devices.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	-	-	-
CO6	-	-	-	-	-	-	-	-	2	-	-	-

Bachelor's in Medical Radio Imaging and Technology IInd year

Course code	**:**	BMRT-202
Course Name	**:**	Orientation in Para clinical Imagin
Semester /Year	**:**	IInd year

	L	**T**	**P**	**C**

UNIT-I

- Fluoroscopy: Image intensifier & TV Monitor, image formation and quality, patient radiation dose and its safety measures, Digital Fluoroscopy,
- Mammography; Basic principle, equipment & image acquisition, Screen film system, image formation and quality, Patient radiation dose and its safety measures, Digital
- Mammography.
- C.R (principle, equipment & imaging System).
- Digital Radiography (principle, equipment & imaging System).
- Ultrasound: Physical characteristics of sound transducer characteristics of ultrasound beam interaction of ultrasound and matter. Doppler technique real the ultrasound instrumentation bio effect and safety consideration.

UNIT-II

- Pictorial archiving & Communication system (PACS)
- Computers in Radiology.
- Tele Radiology system.
- Radiation protection principle: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding. Importance of 'ALARA'.
- Shielding materials Radiation survey and personnel monitoring devices film badge, TLD badges pocket dosimeters

CO1
CO2

PRACTICAL BASED ON THEORY

Study with charts, models & power point presentation in Fluoroscopy, Mammography, Digital Radiography, Radiation protection, involving students to present and discuss.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To outline about two different modalities of radiography i.e Fluoroscopy and mammography.
CO2	To done contrasting between computed and digital radiography.
CO3	To link between data communication in the radiology department and computers in radiology.
CO4	To link between data communication in the radiology department and computers in radiology.
CO5	To comment on Tele radiology system and review various principles of radiation protection..
CO6	To manage shielding materials, radiation survey meters and personnel monitoring devices.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bachelor's in Medical Radio Imaging and Technology IInd year

Course code	**:**	BMRT-203
Course Name	**:**	Orientation in Para clinical Imaging
Semester /Year	**:**	IInd year

	L	T	P	C

Course Outcomes CO1: To Describe the professional laws and ethics. CO2: To discuss the legal aspect and medical ethics in health setup CO3: To Demonstrate patient handling and preparation. CO4: To assess the importance Chest, abdomen, pelvis and extremities Radiography. CO5: To evaluate the radiographic image quality CO6: To design the parameter for identification of radiographic image quality
Common terminology Patient handling & Preparation Clinical, Ethical & Legal Responsibility, (including medico legal /Accident cases) **Chest Radiography** –Basic views (PA & AP) - aspiratory & expiratory films- special chest views & their significance – larynx- trachea- thoracic inlet -Sternum - Ribs – Heart and great vessels – mediastinum - Diaphragm – double exposure technique. Abdomen & Pelvic Radiography – all projection – the acute abdomen investigation. **Abdomen and Pelvis:** Preparation of patient, positioning for fluid and air Levels in abdomen. Basic and special projection for Abdomen and Pelvis **Extremities Radiography**– Hand, Finger, Wrist joint- Forearm -Elbow joint – humerus Shoulder joint. Foot – Toes- Tarsal bones -Ankle joint - Knee joint – patella –tibia- femur – Hip joint– pelvis -sacroiliac joint. **Spine Radiography** -Vertebral column – Atlanta occipital articulation- cervical spine- dorsal spine - lumbar spine – sacrum -vertebral canal- vertebral foramen. **Skull Radiography** – general, sella – temporal bone – mastoid – optic foramen –Internal auditory canal – Superior and inferior orbital fissure – base of skull **facial bones** – petrous apex – Zygomatic bone, nasal bone, sinuses of skull – mandible – Tempro-mandibular joint – Paranasal sinuses Radiography **Ward mobile radiography:** General precautions, Asepsis in techniques-Checking of mains supply and functions of equipment, selection of exposure factors, explosion risks. Radiation protection and rapid processing techniques. **PRACTICALS BASED ON THEORY** **Study with charts, models & power point presentation**

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To Describe the professional laws and ethics.
CO2	To discuss the legal aspect and medical ethics in health setup
CO3	To Demonstrate patient handling and preparation. .
CO4	To assess the importance Chest, abdomen, pelvis and extremities Radiography.
CO5	To evaluate the radiographic image quality..

CO6	To design the parameter for identification of radiographic image quality..

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bachelor's in Medical Radio Imaging and Technology IInd year

Course code	**:**	BMRT-204
Course Name	**:**	Special Radiological Procedures
Semester /Year	**:**	IInd year

	L	**T**	**P**	**C**

- Contrast Media; properties, Types, Reaction and treatment of contrast media.
- Emergency drug used in Radiology Department.
- Patient handling & Preparation.
- **PROCEDURES OF G.I. TRACT:**
  a) Barium Swallow
  b) Barium Meal Series
  c) Barium Meal Follow Through
  d) Barium Enema(Small bowel enema, Double Contrast Enema)
  e) Loopogram
  f) Sinogram
- **PROCEDURES OF Excretory System**
  IVP , RGU, MCU, Ascending Urethrography , Voiding Cystography(VCUG)
- **Reproductive system**
  HSG (HysteroSalpingoraphy)
- **Hepatobiliary system**

T-tube cholangiography , ERCP, Percutaneous Trans hepatic Cholecystography

- **Spinal cord**

  Myelography
- **Other procedures**

  a) Sialography, Dacrocystography, Sinograpy, Fistulography Related anatomy

  b) Associated pathology and radiographic appearance Indications, contraindications and technique

PRACTICAL BASED ON THEORY

Study with charts, models & power point presentation

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To Describe the properties of contrast media..
CO2	To discuss the legal aspect and medical ethics in health setup. …
CO3	To Demonstrate patient handling and preparation
CO4	To assess the importance of Radiological Procedure done in Radiology Department
CO5	To evaluate the radiographic image quality
CO6	To design the parameter for identification of radiographic image quality

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bachelor's in Medical Radio Imaging and Technology IInd year

Course code	**:**	BMRT-204
Course Name	**:**	Special Radiological Procedures
Semester /Year	**:**	IInd year

	L	T	P	C

UNIT-I

- Historical developments, its principle and applications, various generations.
- Imaging principles in computed tomography Instrumentation of CT scan Advances in Detector technology Slip ring technology Helical CT Single slice and Multi slice CT Scan system (recent advancement in ct scanner)
- HRCT of Lungs Technical aspects Volumetric HRCT Expiratory HRCT HRCT protocols Artifacts
- CT angiography, coronary angiography, CT guided biopsies & drainage, CT guided FNAC.
- Protocols for adult Whole Body CT Protocols for pediatric Whole Body CT.

UNIT-II

- Principles of magnetic resonance imaging Spin Precession Relaxation time Pulse cycle T1 weighted image T2 weighted image Proton density image.
- MR Instrumentation Types of magnets RF transmitter &receiver coils Gradient coils Shim coils RF shielding Computers.
- Pulse sequences 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 and Fast imaging sequences Advanced pulse sequences.
- MR contrast media MR angiography – TOF & PCA MR Spectroscopy.
- Protocols in MRI for whole body MRI artifacts Safety aspects in MRI
- Advantage of MRI over computed tomography or USG. Its limitations and use and cross sectional anatomy.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To outline developments, Principe and various generations of computed tomography.
CO2	To interpret technical aspects behind instrumentation of CT scan, advancements in detector technology, helical CT, and HRCT.
CO3	To implement standard protocols of CT angiography, CT guided biopsies, CT guided FNAC, adult and pediatric whole body CT.
CO4	To illustrate the basic concept behind principle of MRI, precession, TR, T1 weighted, T2 weighted and proton density.
CO5	To assess basic and advanced pulse sequences, MR angiography and MR spectroscopy.
CO6	To write about standard protocols of MRI, artifact's and safety aspects of MRI and advantages of MRI over CT.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bachelor's in Medical Radio Imaging and Technology IIIrd year

Course code	**:**	BMRT-301
Course Name	**:**	Orientation in Clinical Sciences
Semester /Year	**:**	**IIIrd** year

	L	T	P	C

(Only Outline i.e. Clinical features & Lab Investigation of the following conditions)

UNIT-I

MEDICINE

- Pericarditis
- Valvular diseases
- Rhematic Heart Disease
- Heart failure
- Hypertension

UNIT-II

- Chronic Bronchitis
- Emphysema
- Brochietasis
- Pneumonia
- Tuberculosis
- Pleura effusion
- Empyema
- Spntaneus Pheumothorax

UNIT-III

- Achalsia Cardia
- Peptic ulcer
- Intestinal obstruction
- Crohns disease
- Ulcerative Colitis
- Pancreatitis
- Portal Hypertension
- Ascitis
- Cirrhosis

- Cholecyslitis

UNIT-IV

- UTI
- Glomerulonephritis
- Nephrotic sysdrome
- Urinary Calculi
- Polysystic Kidney disease

UNIT-V

- Cerebral Vascular Dsorders
- Meningitis
- Encephalitis

UNIT-VI

ORTHPAEDICS

Fracture

- Type Mechanism, Healing, Delayed Union, Non- complication
- Injuries of the shoulder gridle, Dislocation of shoulder
- # of Humerus, Elbow Forearm
- Of Distal Radius & Ulna
- Injuries of the Capus
- Dislocation of Hip
- # Femur, Tibia, Ankle, Calcaneum
- Acute & chronic osteoarthritis
- Rhematoid arthritis
- Pagets Disease
- Ankylosing spondylitis
- Club foot
- Bone Tumour- Benign, Malignant

UNIT-VII

SURGERY

- Cholelithiasis
- Peritonitis
- Subphremic Abcess
- Appendicitis
- Hydronephrosis
- Benign Hypertrophy prostatye
- Sinusitis

OBSTRETRICS

Diagnosis of Pregnancy

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To outline developments, Principe and various generations of computed tomography.
CO2	To interpret technical aspects behind instrumentation of CT scan, advancements in detector technology, helical CT, and HRCT.
CO3	To implement standard protocols of CT angiography, CT guided biopsies, CT guided FNAC, adult and pediatric whole body CT.
CO4	To illustrate the basic concept behind principle of MRI, precession, TR, T1 weighted, T2 weighted and proton density.
CO5	To assess basic and advanced pulse sequences, MR angiography and MR spectroscopy.
CO6	To write about standard protocols of MRI, artifact's and safety aspects of MRI and advantages of MRI over CT.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bachelor's in Medical Radio Imaging and Technology IIIrd year

Course code	**:**	BMRT-302
Course Name	**:**	Radiotherapy Planning and Radiation Therapy
Semester /Year	**:**	**IIIrd** year

	L	**T**	**P**	**C**

UNIT-I • Definition of treatment planning. Planning procedure in general and special Technique. Terminology, tumors localization and target volume • Iso dose Chart, Parameters of Iso dose chart. • Field selection of treatment Planning in Teletherapy, Parallels and Multiple field, Wedge field technique, Singles wedge field, Stationary's • Rotation Therapy. • Acquisition of patient data- Body Contours, Radiography equipment used in Radiotherapy, Role of portal films in treatment planning. • Treatment Planning Setup-Treatment Simulation, CT Simulator, Patient Partitioning, Field Blocks, Simulation Procedure • Role of treatment shell immobilization devices and later in patients set up and Positioning.
UNIT-II • Definitions of Bragg-Peak, Percentage depth dose, Beak scatter factor, tissue air-ratio, tissue maximum ratio, wedge angle, hinge angle. • Beams flattering filters, scattering foils. Physical properties of phantoms, phantom materials, bolus and bolus substitutes
PRACTICAL BASED ON THEORY **Study with charts, models & power point presentation**

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To define role of radiotherapy, its planning and procedures.
CO2	To express proper simulation techniques
CO3	To efficiently present terminology of radiotherapy
CO4	To organize treatment setup efficiently with use of proper immobilization

	devices
CO5	To measure percentage of radiation dose at particular depth
CO6	To write about physical properties of particular phantom, bolus and shell immobilization devices.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bachelor's in Medical Radio Imaging and Technology IIIrd year

Course code	**:**	BMRT-303
Course Name	**:**	Equipments for Radiotherapy including Newer Developments
Semester /Year	**:**	IIIrd year

	L	**T**	**P**	**C**

• Introduction of Ortho voltage and Kilo voltage equipment • Gamma ray sources used in radiotherapy. • Cobalt 60 Units, its construction and source housing and handling mechanism. • Linear Accelerator, Principle, working, tube design, wave guide system, target design beam bending system. • Radio-frequency generators like magnetron, Klystron and Betatron. • Brach therapy: Requirement of Brach therapy source, Clinical Applications. • Basic principle of Manual and remote after-loading system. • Gamma knife
PRACTICAL BASED ON THEORY **Study with charts, models & power point presentation**

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To define role of radiotherapy, its planning and procedures. Define kilo voltage and ortho voltage techniques of radiotherapy.
CO2	Interpret design and construction of various different Radiotherapy machines associated with Radiotherapy techniques
CO3	Examine different types of Radio frequency generators can be used in radiotherapy.
CO4	Illustrate clinical applications of internal radiation therapy
CO5	Experiment techniques for administration of internal radiation therapy.
CO6	Write about working principal of the gamma knife. .

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bachelor's in Medical Radio Imaging and Technology IIIrd year

Course code	**:**	BMRT-30
Course Name	**:**	Interventional Radiological Procedures and Techniques
Semester /Year	**:**	IIIrd year

	L	**T**	**P**	**C**

1) Interventional Radiology
   a) Definition of interventional radiology.
   b) Basic of Interventional radiology.
   c) Interventional radiology suite: machine handling, imaging detector, patient positioning, pulsed fluoroscopy, fluoroscopy mode.
   d) DSA
   e) Name of different interventional radiology procedure and the modality (CT, C-arm, USG, and DSA/ Cath Lab Guidance).
   f) Differentiation between lines, tubes and drain in imaging correct or not.
2) Equipment used in various interventional radiology procedures.
   a) Cath Lab / DSA equipment and machine part
   b) C-arm equipment: instrumentation and working procedure
   c) Tools of the trade:-Type of needles, Type of vascular sheath, Type of guide wires, Type of catheters, Type of balloon, Type of stent, Sterilization of interventional radiology equipment, Type of biopsy guns, Type of drains.
3) General principles of interventional radiology procedures
   a) History
   b) Pre procedure tasks:-Consent ,Patient evaluation and management ,Safety consideration ,Medications ,Tools ,Contrast agents
   c) Intra procedure tasks;-Sedation ,Antibiotic prophylaxis ,Blood pressure control ,Anticoagulation ,Fluid management ,Vascular access ,Imaging ,Treatment of adverse events and reaction
   d) Post procedure patient care;-Sheath removal ,Patient shifting ,Patient monitoring ,Images storage and transfers ,Orders ,Discharge criteria
4) Vascular and non vascular anatomy and pathology with gross anatomy appearance on DSA and other image modality.
5) Clinical application: disease diagnosis, severity interpretation, case follow up
6) Sterile techniques in angiography procedures
   a) Common interventional radiology procedures
   b) Types of interventional radiology procedure: vascular and non vascular
   c) Definition, indication contraindication
   d) Patient preparation and technique
   e) Needle puncture: direct and guided
   f) Catheter angiography (cerebral, peripheral, visceral)
7) Anesthesia and emergency drugs used in interventional radiology
   a) Anesthesia equipment handling
   b) Facilities regarding general anesthesia in the interventional radiology department
   c) Anesthetic problems associated with specific technique: Vascular studies ,Non vascular studies ,Carotid angiography, Venography
8) Embolization agents
9) Radiation safety in interventional radiology department

10) Basic knowledge of OT instruments and sterility **PRACTICAL BASED ON THEORY** **Study with charts, models & power point presentation**

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To define role of radiotherapy, its planning and procedures. Define kilo voltage and ortho voltage techniques of radiotherapy.
CO2	Interpret design and construction of various different Radiotherapy machines associated with Radiotherapy techniques
CO3	Examine different types of Radio frequency generators can be used in radiotherapy.
CO4	Illustrate clinical applications of internal radiation therapy
CO5	Experiment techniques for administration of internal radiation therapy.
CO6	Write about working principal of the gamma knife. .

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bachelor's in Medical Radio Imaging and Technology IIIrd year

Course code	**:**	BMRT-303
Course Name	**:**	Patien care and radiation protection in diagnostic radiology
Semester /Year	**:**	IIIrd year

	L	**T**	**P**	**C**

- Introduction to Patient Care Responsibilities of the Healthcare facility Responsibilities of the Imaging Technologist.
- General Patient Care Patient transfer technique Restraint techniques Aspects of patient comfort Specific patient conditions Security of patient property Obtaining vital signs Laying up a sterile trolley IV injection administration
- Patient care during Investigation G.I. Tract, Biliary tract, Respiratory tract, Gynecology, Cardiovascular, Lymphatic system, C.N.S. etc
- Infection Control Isolation technique Infection sources – Transmission modes Procedures Psychological considerations Sterilization & sterile techniques.
- Patient Education Communication Patient communication problems Explanation of examinations Radiation Safety / Protection Interacting with terminally ill patient Informed Consent.
- Aim & Principle of Radiation Protection Concept of ALARA, ICRP regulation, Radiation Protection in: Radiography, CT, Fluoroscopy, Mammography, Ward radiography, radiation shielding.
- Direct & Indirect effects of radiation, Stochastic, Deterministic effects, Somatic, Genetic effects, dose relationship, Antenatal exposure.

PRACTICAL BASED ON THEORY

Study with charts, models & power point presentation

Course outcomes (COs):

Upon successful completion of the course a student will be able to

(BASED ON BLOOMS TAXONOMY)* MIN.03 –MAX.06

CO1	To describe the Importance of the Professional Laws &Ethics.
CO2	To discuss the legal aspect and medical ethics in health setup
CO3	To demonstrate body mechanics & transferring of Patient..
CO4	To assess the Knowledge of departmental safety and infection control.
CO5	To evaluate the roll of Radiological exposure & protection principle..
CO6	To design the parameter for identification of patient care responsibility & health care facility of a radiographer . .

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												