

SCHEME & SYLLABUS
B.Sc. Medical Radiology & Imaging
Technology



Department of Life Sciences & Allied Health Sciences

(UIS)

Sant Baba Bhag Singh University
2021

ABOUT THE DEPARTMENT

The department of Life Sciences formerly known as the Department of Natural Sciences was established in the year 2015 with only two UG programmes. Over the years this department has flourished and is offering various Programmes and courses at graduate, post-graduate and doctorate level in field of Botany, Zoology, Biotechnology, Biochemistry, Microbiology and Laboratory Sciences. The department is nurtured by the highly qualified and dedicated Faculty, honored by various international and national awards. The department is blessed to have specialized faculties in various fields of Life Sciences viz. Plant physiology, Plant Biochemistry, Plant Microbe interaction, Stress Physiology, Chemical ecology, Microbial Physiology, Industrial Microbiology, Clinical microbiology, Microbial Biotechnology, Animal Biotechnology, Fisheries, Parasitology, Molecular biology, Entomology, Sericulture, Animal toxicology, Endocrinology, Biochemistry and Biodiversity.

SALIENT FEATURES OF THE DEPARTMENT

1. At SBBS University the focus of Department is on conducting innovative teaching ,fundamental multi disciplinary research in life sciences.
2. The department is disseminating various educational missions via e-learning platform in the form of SWAYAM, Virtual lab etc.
3. The department is equipped with a number of instruments and facilities like, UV- Visible Spectro photometer ,High Speed Centrifuge, Deep Freezer, Laminar Air flow, Air Samplers, Auto clave, Incubator, Photo actometer, Air condition Labs, Wi-Fi, Library etc.
4. The department has organized a large number of conferences, seminars, synopsis and workshops. National and International eminent scientists of the country have been associated with the Department as visiting and honorary professors

B.Sc.MRIT(Bachelor of Medical Radiology And Imaging Technology) : BSc MRIT is a route for the medical, non-medical and diploma students of 10+2 to join the community of Radio Imaging Technology professionals. The program is designed to build theoretical knowledge and practical skill set for performing & developing efficient and resource optimized medical Imaging procedures.

VISION

To bridge the gap between demand and supply for Life Science and Allied Health Professionals with grooming young generations along with their moral and spiritual development.

MISSION

To radiate the knowledge of Life Science and Allied Health Science through quality education by using latest technology, modern infrastructure and the framework needed for the development of professionals.

ELIGIBILITY CRITERIA

10+2 Medical/2 years Diploma in RIT/Non-Med with 50% marks.

DURATION

3 Year

CAREER PATHWAYS

The program is designed to meet the growing requirement of qualified professionals in field of IT industry and education. B.Sc. graduates are hired both by Government and private organizations. They may join Post Graduation Courses further.

- Government Jobs : Prepare students for various government jobs such as at govt .hospitals, military and other public sectors etc.
- Higher Studies: This pathway prepares students for Higher Studies and helps in their research also.

Entrepreneurship:

To set up new venture.

Program Objective

PO1	Disciplinary Knowledge: The student has acquired in-depth knowledge of the various theoretical and practical concepts regarding the role of radiographer, technologist and Radiology.
PO2	Critical Thinking: Critical thinking as an attribute enables a student to identify, formulate and apply knowledge to develop critical thinking and practical understanding in the field of Radiology to find solutions for human benefits.
PO3	Problem Solving: gain hands on experience in state-of-the-art Radiological equipment that could enrich them to perform high through put research on radiological procedures in field of radio-imaging technology
PO4	Scientific /Analytical Reasoning: Students learn to investigate, experiments/ theoretical methods, relate information and interpretation of data based on scientific reasoning. The student will be able to draw logical conclusions based on a group of observations, mathematical techniques and measurements
PO5	Multicultural Competence: The ability to understand and consecutively relate to uniqueness of each student in light of diverse culture that influence in multy prospective
PO6	Environment & Sustainability: Student's ability to understand overall goal of conserving natural resources and create and develop energy efficient projects and practice.
PO7	Research related skills & Ethics: develop the skill to think independently, plan research and execute it in different fields of Microbiology. The student is aware of what constitutes unethical behaviour-- fabrication, plagiarism and misrepresentation or manipulation of data
PO8	Individual and Teamwork: acquire the ability to function effectively on teams to accomplish a common goal. The student is capable of contributing meaningfully to team ethos and goals.
PO9	Communication Skills: Students are encouraged to communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing
PO10	Lifelong Learning: students opt for higher studies, jobs in various sectors and entrepreneurship abilities in the field of microbiology

Program Outcomes

After Completion of the program, the students would be able to

PEO1. The students who will Complete this Program will be able to have a lifelong knowledge of all the Equipment's used in it along with basic science knowledge.

PEO2: Radiology is a new stream in Allied Sciences & there is a Major need of these professionals. Thus, Creating a vast employability option.

PEO3: Radiology Technicians/Assistants will work in Radiology & Operation Theatres etc. Along with Radiologist & thus will be having a great & Important role in hospital & ensuring their sustainability.

PEO4: By choosing this stream, the students will get to know about the equipment's & Machines used in Radiology & will be able to operate all modern Radiology Equipment's

PEO5: This program will ensure overall professional development of students & in their behaviour & manners too.

PEO6: This Program can do an overall development of the student to be able to have all the technical aspects about Radiology & Basic Sciences.

PEO7: This Program will build technical knowledge in the student so that he/she can be able to assist a radiologist in diagnosis & related fields of Science.

PEO8: This Program will build the Knowledge of Basic Science like Anatomy, Physiology, Microbiology, Pathology etc.

Program Specific Outcomes

PSO1: Ability to analyse, Monitor & Examine the patient.

PSO2: Understand the fundamentals and applications of Radiology & Emergency Care equipment's.

PSO3: Ability to have knowledge of BLS & ACLS and ability to deliver it whenever required.

PSO4: Ability to Assist a radiologist in diagnosing various diseases with the help of imaging.

PSO5: Able to detect any Changes in patient's physiological status & able to tackle all types of Complications.

PSO6: Knowledge of Basic Science of Anatomy, Physiology, Pathology & Microbiology etc.

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2.	Basics Physics Including Radiological Physics	RDL105	3	1
3.	Conventional Radiography and Equipment	RDL109	4	1
4.	Radiographic and Image Processing Techniques	RDL113	5	1
5.	Human Anatomy and PhysiologyI Practical	RDL103	6	1
6.	Basics physics including radiological physics practical	RDL107	7	1
7.	Conventional radiography and equipment practical	RDL111	8	1
8.	Radiographic and image processing techniques practical	RDL115	9	1
9.	Communication Skill-I	ENG121	10-11	1
10.	Communication skill-I Practical	ENG123	12	1
11.	Human Anatomy and Physiology II	RDL102	13-14	2
12.	Clinical Radiography-Positioning part I	RDL106	15	2
13.	Modern Radiological & Imaging Equipment Including Physics	RDL110	16	2
14	Contrast and Special Radiography Procedures	RDL114	17	2

15	Communication Skills II	ENG114	18	2
16	Human Anatomy and Physiology II practical	RDL104	19	2
17	Clinical Radiography- positioning part I Practical	RDL108	20	2
18	Modern Radiological & Imaging Equipment Including Physics Practical	RDL112	21	2
19	Contrast and Special Radiography Procedures Practical	RDL116	22	2
20	Communication skill-II practical	ENG116	23	2
21	Physics Of Newer Imaging Modalities	RDL201	24-25	3
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23	Clinical Radiography-Positioning Part II	RDL205	27	3
24	Clinical Radiography-Positioning Part II	RDL205	28	3
25	Newer Modalities Imaging Techniques Including Patient Care	RDL209	29	3
26	Newer Modalities Imaging Techniques Including Patient Care	RDL211	30	3
24	Quality Control in Radiology And Radiation Safety	RDL213	31	3
25	Basics of Computers Practical	CSE213	32-34	3
26	Environmental Science	EVS001	35-36	3
27	First Aid	MLS215	37	3
28	Gender equity	SSC001	38	3
29	Cross Sectional Anatomy and Physiology	RDL202	39	4
30	Physics of Advanced Imaging Technology	RDL206	40	4

31	Radiographic Techniques of Advanced Imaging Technology	RDL210	41	4
32	Regulatory Requirements In Diagnostic Radiology & Imaging, Act And Rules, Regulations For JCI,NABH,NABHR	RDL214	42	4
33	Introduction To Healthcare Delivery System	MLS222	43	4
34	Medical Terminology	RDL220	44-45	4
35	Cross Sectional Anatomy and Physiology Practical	RDL204	46	4
36	Radiographic Techniques of Advanced Imaging Technology Practical	RDL212	47	4
37	Quality Assurance & Radiation Safety(AERB Guidelines) In Diagnostic Radiology	RDL301	48	5
38	Hospital Practice& Care of Patients	RDL305	49	5
39	Nuclear Medicine	RDL309	50	5
40	Research Methodology and Biostatistics	RDL311	51	5
41	Quality Assurance&Radiation Safety(AERBG uidelines)InDiagnosticRadiologyPractical	RDL303	52	5
42	Hospital Practice & Care of Patients Practical	RDL307	53	5
43	Nuclear Medicine Practical	RDL313	54	5
44	Internship and Project Report	RDL302	56	6
45	Generic skills and Entrepreneurship	COM317	55	5

Course Scheme

SEMESTER I

I. Theory Subjects

Sr. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	RDL101	Human Anatomy and Physiology I	4:0:0	4:0:0	4	4
2	RDL105	Basics Physics Including Radiological Physics	3:0:0	3:0:0	3	3
3	RDL109	Conventional Radiography and Equipment	3:0:0	3:0:0	3	3
4	RDL113	Radiographic and Image Processing Techniques	3:0:0	3:0:0	3	3
5	ENG121	Communication Skill-I	2:0:0	2:0:0	2	2

II. Practical Subjects

1	RDL103	Human Anatomy and Physiology I Practical	0:0:2	0:0:2	2	1
2	RDL107	Basics physics including radiological physics practical	0:0:3	0:0:2	3	1.5
3	RDL111	Conventional radiography and equipment practical	0:0:3	0:0:2	3	1.5
4	RDL115	Radiographic and image processing techniques practical	0:0:3	0:0:2	3	1.5
5	ENG123	Communication skill-I Practical	0:0:2	0:0:2	2	1

Total Contact Hours: 28
Total Credit Hours: 21.5

Semester II

I. Theory Subjects

Sr. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	RDL102	Human Anatomy and Physiology II	4:0:0	4:0:0	4	4
2	RDL106	Clinical Radiography-Positioning part I	3:0:0	3:0:0	3	3
3	RDL110	Modern Radiological & Imaging Equipment Including Physics	3:0:0	3:0:0	3	3
4	RDL114	Contrast and Special Radiography Procedures	3:0:0	3:0:0	3	3
5	ENG114	Communication Skills II	2:0:0	2:0:0	2	2

II. Practical Subjects

1	RDL104	Human Anatomy and Physiology II practical	0:0:2	0:0:1.5	2	1
2	RDL108	Clinical Radiography-positioning part I Practical	0:0:3	0:0:1.5	3	1.5
3	RDL112	Modern Radiological & Imaging Equipment Including Physics Practical	0:0:3	0:0:1.5	3	1.5
4	RDL116	Contrast and Special Radiography Procedures Practical	0:0:3	0:0:1.5	3	1.5
5	PT 102/104/106	Physical Training (NSO/NSS/NCC)	0:0:2	Non Credits	2	NC
6	ENG116	Communication skill- II Lab	2:0:0	2:0:0	2	1

Total Contact hrs: 30

Total Credit Hours: 21.5

Semester-III

I. Theory Subjects

Sr. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	RDL201	Physics Of Newer Imaging Modalities	3:0:0	3:0:0	3	3
2	RDL205	Clinical Radiography-Positioning Part II	3:0:0	3:0:0	3	3
3	RDL209	Newer Modalities Imaging Techniques Including Patient Care	3:0:0	3:0:0	3	3
4	RDL213	Quality Control In Radiology And Radiation Safety	3:0:0	3:0:0	3	3
5	EVS001	Environmental Science	3:0:0	3:0:0	3	3
6	MLS215	First Aid	2:0:0	2:0:0	2	2
7	SSC001	Gender Equity	3:0:0	3:0:0	3	3

II. Practical Subject

1	RDL203	Physics Of Newer Imaging Modalities Practical	0:0:3	0:0:1.5	3	1.5
2	RDL207	Clinical Radiography-Positioning Part II Practical	0:0:3	0:0:1.5	3	1.5
3	RDL 211	Newer Modalities Imaging Techniques Including Patient Care Practical	0:0:3	0:0:1.5	3	1.5
4	CSE 213	Basics of Computers Practical	0:0:3	0:0:1.5	3	1.5

Total Contact hrs: 32
Total Credit Hours: 26

Semester-IV

I. Theory Subjects

Sr. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	RDL202	Cross Sectional Anatomy and Physiology	3:0:0	3:0:0	3	3
2	RDL206	Physics of Advanced Imaging Technology	3:0:0	3:0:0	3	3
3	RDL210	Radiographic Techniques of Advanced Imaging Technology	3:0:0	3:0:0	3	3
4	RDL214	Regulatory Requirements in Diagnostic Radiology & Imaging, Act And Rules, Regulations For JCI, NABH, NABHR	3:0:0	3:0:0	3	3
5	MLS222	Introduction To Healthcare Delivery System	2:0:0	2:0:0	2	2
6	RDL220	Medical Terminology	2:0:0	2:0:0	2	2

Practical Subjects

1	RDL204	Cross Sectional Anatomy and Physiology Practical	0:0:3	0:0:1.5	3	1.5
2	RDL212	Radiographic Techniques of Advanced Imaging Technology Practical	0:0:3	0:0:1.5	3	1.5
3	PT102/104/106	PT101/103/105 Physical Training (NSO/NSS/NCC)	0:0:2	Non Credits	2	NC

Total Contact hrs: 24
Total Credit Hours: 19

Semester-V

I. Theory Subjects

Sr. No.	Subject Code	Subject Name	L:T:P	Credit hours	Total Contact Hours	Total Credits
1	RDL301	Quality Assurance & Radiation Safety (AERB Guidelines) In Diagnostic Radiology	3:0:0	3:0:0	3	3
2	RDL305	Hospital Practice & Care of Patients	3:0:0	3:0:0	3	3
3	RDL309	Nuclear Medicine	3:0:0	3:0:0	3	3
4	RDL311	Research Methodology and Biostatistics	3:0:0	3:0:0	3	3
5	COM317	Generic skills and Entrepreneurship	2:0:0	2:0:0	2	2

Practical Subjects

1	RDL303	Quality Assurance & Radiation Safety (AERB Guidelines) In Diagnostic Radiology Practical	0:0:3	0:0:1.5	3	1.5
2	RDL307	Hospital Practice & Care of Patients Practical	0:0:4	0:0:2	4	2
3	RDL313	Nuclear Medicine Practical	0:0:3	0:0:1.5	3	1.5
4	PT101/103/105	PT101/103/105 Physical Training (NSO/NSS/NCC	0:0:2	Non-Credits	2	NC

Total Contact hrs: 26
Total Credit Hours: 19

Semester – VI

I. Training

Sr. No.	Subject Code	Subject Name	L:T:P	Credit hours	Total Contact Hours	Total Credits
1	RDL302	Internship and Project Report	0:0:30	0:0:15	30	15

Total Credit: 15

Course Scheme Summary

Sem.	L	T	P	Contact hrs/wk	Credits	Project (prj)/ Training (trg)
1	15	0	9	28	21.5	NC
2	15	0	9	30	21.5	NC
3	17	0	12	32	26	NC
4	14	0	10	24	19	NC
5	14	0	10	26	19	NC
6	0	0	30	30	15	6 months

Total Contact hrs for I-VI semester: 170
Total Credit Hours for I-VI semester: 122

CO/PO Mapping										
(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak										
COs	Programme Outcomes (POs)									
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	W	M	M	W	S	S	S	S	M
CO2	S	M	W	W	W	S	S	S	S	S
CO3	S	W	W	W	W	S	S	S	S	W
CO4	M	W	W	M	W	S	S	S	W	S
CO5	M	W	W	W	W	S	S	S	W	S

***FIRST
SEMESTER***

Human Anatomy & Physiology-I

Course Code	RDL101
Course Title	Human Anatomy & Physiology-I
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective	<ul style="list-style-type: none"> • To identify and relate basic concepts of structure and function of cells, tissues and organs. • To understand the anatomical organization, coordination and integrated functions of human body.
Course Outcomes	<ul style="list-style-type: none"> • Able to explain the anatomy, physiology and functions of various organs mentioned in chapters. • Able to understand the homeostatic mechanisms and altered physiology of digestive system. • Apply concepts and knowledge of terminology related to the cardiovascular, digestive system and structure and function of blood and lymphatic system

UNIT-I

General anatomy: Introduction to anatomical terms and organization of the human body, Definition of anatomy and its divisions, Terms of location, positions and planes.

Tissues –Definitions, Types, characteristics, classification, location and functions.

UNIT-II

Musculoskeletal system: Bones – types, structure, Bone formation and growth, Axial & appendicular skeleton, Joints–classification and structure, Types and structure of skeletal muscles, mechanism of muscle contraction, isotonic and isometric contractions, energy sources of muscle contractions, motor UNIT, Movements at the joints and muscles producing movements.

UNIT-III

Cardiovascular System: Circulatory system – Structure of the Heart, Structure of Blood Vessels – arterial and venous system. Anatomy of heart, cardiac cycle, heart sounds, definitions of cardiac output, stroke volume, principles of measurements of cardiac output. ECG – methods of recording and ECG waves. Normal values of blood pressure, heart rate and their regulation in brief.

Structure and Functions of Blood: Components, names of developmental stages of RBC, functions and fate of RBC, functions of WBC and platelets, Basis of blood coagulation and blood groups – ABO & Rh.

Lymphatic System: Gross and microscopic structure of lymphatic tissue - lymph vessels and lymph nodes, functions of lymph, structure and function of thymus and spleen.

UNIT-IV

Respiratory System: Parts; Nasal cavity and Paranasal air sinuses, trachea, Gross and microscopic structure of lungs, Diaphragm and Pleura, Principles of respiration, respiratory muscles, lung volumes and capacities, collection and composition of inspired alveolar and expired airs, transport of oxygen and carbon dioxide, brief account of respiratory regulation, Definition of hypoxia, Cyanosis and asphyxia, Methods of artificial respiration.

Digestive System: Parts of alimentary canal, structure and functions of tongue, pharynx, oesophagus, stomach, small and large intestine and anus, principles of secretion and movements of gastrointestinal tract. (G.I tract)

Digestive Glands: Structure and function of Salivary glands, liver and pancreas, functional anatomy of G.I.T and functions of G.I secretions.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Anatomy & Physiology- Ross and Wilson	Anne Waugh & Allison Grant	Churchill Living Stone
2	Anatomy and Physiology: Understanding the Human Body	Robert Clark	Jones & Bartlett publishers
3.	Functional Histology	James S. lowe, Barbara young, Allen Stevens & John W heath	Elsevier
4.	Text book of human Histology with color Atlas and Practical Guide	Inderjit singh	Jaypee Brothers Medical publishers
5.	Understanding Human Anatomy and Physiology	William Davis	McGraw Hill

Basic Physics including Radiological Physics

Course Code	RDL105
Course Title	Basic Physics including Radiological Physics
Type of Course	Theory
L T P	3.0.0
Credits	3
Course Prerequisites	10+2 (Science)
Course Objectives (CO)	CO1: The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. CO2: This course also provides fundamental idea about circuit analysis, working principles of machines. CO3: Study about transformers, basic principles of transformer, along with its uses. CO4: To study about various rectifiers, p-type and n-type semiconductors. CO5: Overall Knowledge of units of radiation.

UNIT- I

Basic idea on measurement & units, force, work, heat and energy

Electrostatics - Electric charge and its units, capacitor, its principle, Energy stored in Capacitor, electric current, magnetic effects of current, solenoids, ohm`s law and resistance.

UNIT-II

Transformers: Principles of transformer, Electromagnetic induction, transformer design, efficiency of transformer, Various types of transformers and working of step - down and step up along with its uses.

Generators: Types of generators, 3 phase, 6 and 12 pulse circuits, falling load generators, Advantages of the 3-phase over single phase, Radiographic advantages of 3 phase X-Ray generators over single phase, 12 pulse circuit.

UNIT-III

Rectifiers: Introduction, principle of rectification, half wave and full wave rectification ,energy bands in solids, the semiconductor, p-type and n-type semiconductors, density of charge carriers and conductivity, p-n junction, p-n junction diode, p-n junction diode as rectifier (half- wave and full-wave rectifier),

UNIT-V

Units of radiation, ICRU definition of absorbed dose, Quality factor, dose equivalent. Basic principles of ionization chambers, proportional counters, G.M counters and scintillation detectors, thermo luminescent dosimeters, film batches

Text- Books

S. No.	Author(s)	Title	Publisher
1	Dr.S.K.Bhargava	Radiology For Residents And Technicians	CBS
2	K Thayalan	The Physics Of Radiology And Imaging	

Conventional Radiography and Equipment

Course Code	RDL109
Course Title	Conventional Radiography and Equipment
Type of Course	Theory
LTP	3.0.0
Credits	3
Course Prerequisites	10+2(Science)
Course Objectives(CO)	CO1:The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. CO2:This course provides fundamental idea about various radiological equipment's and helpful to tackle complex radiological problems in the scenario of application. CO3:Study about intensifying Screen & Filters: Structure and functions. CO4:Know about how to control of scattered radiation beam limiting devices ,cones, diaphragms. CO5:Understanding about fluorescence and phosphorescence.

UNIT- I

Cassettes:Structure and function, Types, Design features and consideration with loading/unloading, Care and maintenance (cleaning)

UNIT-II

Intensifying Screen & Filters: Structure and functions, common phosphors used for determination of relative speeds, types, screen mounting, care and maintenance of film screen contact.

UNIT-III

Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment,

Grid: Purpose and function, grid ratio, grid cut-off effect on radiation exposure, use of grid, structure and materials.

Types: stationary, parallel, focused, cross-hatch Moving grids. Purpose/advantages/disadvantages

UNIT-IV

Fluoroscopy: Fluorescence and phosphorescence- description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table.

Text-Books

S.No.	Author(s)	Title	Publisher
1	Dr. S.K. Bhargava	Radiology for Residents and technicians	CBS

Radiographic and Image Processing Techniques

Course Code	RDL113
Course Title	Radiographic and Image Processing Techniques
Type of Course	Theory
LTP	3.0.0
Credits	3
Course Prerequisites	10+2(Science)
Course Objectives(CO)	CO1:The purpose of this course to know composition of film, screens, cassette, processing solution, the usage and effect of light. CO2:Perform best storage guidelines for film storage and handling. Select cassette size, Loading & unloading of films. CO3:Study about purpose and location of darkroom. CO4:Study about Image formation. CO5:Knowledge about automatic processing.

UNIT-I

Introduction to X-Rays: Properties of X-Rays, X-Ray production, Bremstrauh lung phenomenon ,factors affecting X-Ray emission spectra, X-Ray quality and quantity.

UNIT-II

Film: Types, composition of single and double coated radiographic films, Screen & Non Screen films, structure of film, characteristic curve. Characteristics (speed, base+fog, gamma, latitude), Film storage rules and guidelines, film handling and care (size, construction and function),film contrast.

UNIT-III

Introduction, purpose and Location of dark room, layout of darkroom, entrance, pasox ,hatch, hangers, safe light, criteria of safe light, safe light test.

UNIT-IV

Image formation, latent image, processing: manual processing,. Developer, fixer, rinser components ,replenisher. Manual technique of developing film.

Automatic processing: Automatic film processor, common errors in processing.

Text-Books

S.No.	Author(s)	Title	Publisher
1	Dr.S. K. Bhargava	Radiology for residents and Technicians	CBS
2	Kthayalan	The physics of radiology and Imaging	

Human Anatomy & Physiology Practical

Course Code	RDL103
Course Title	Human Anatomy & Physiology Practical
Type of course	Practical
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical
Course Objective	Students will be able to learn the basic terminology of anatomy, architecture and functional details of cells, tissues, organs and organ systems.
Course Outcomes	<ul style="list-style-type: none">• Able to explain the anatomy, physiology and functions of various organs mentioned in chapters.• Able to understand the homeostatic mechanisms and altered physiology of digestive system.• Apply concepts and knowledge of terminology related to the cardiovascular, digestive system and structure and function of blood and lymphatic system

List of Experiments

1. Study of following body systems showing all parts through charts and models:

- Musculo-skeletal system: bones and joints
- Cardiovascular system: heart, artery and vein, blood circulation
- Respiratory system: trachea and lungs
- Digestive system: parts of alimentary canal and digestive glands

2. Study of histology of following from permanent slides:

- Types of epithelial tissue
- Skeletal, smooth & cardiac muscle (TS & LS)
- Compact bone (TS & LS)
- Cartilages (hyalin, elastic and fibro-cartilage)
- Artery & vein (TS)
- Spleen (TS)
- Oesophagus (TS)
- Stomach (TS)
- Deudenum (TS)
- Liver (TS)
- Pancreas (TS)

Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.

Basic Physics including Radiological Physics Practical

Course Code	RDL107
Course Title	Basic Physics including Radiological Physics Practical
Type of Course	Practical
L T P	0.0.3
Credits	1.5
Course Prerequisites	10+2 (Science)
Course Objectives (CO)	CO1: The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. This course also provides fundamental idea about circuit analysis, working principles of machines, Know About A.C. and D.C. power supply. CO2: Understanding the heating effect of current, Ammeter, voltmeter, Galvanometer. CO3: To study about TLD badges and their uses and relative merits CO4: Know about various energy bands in solids, the semiconductor CO5: Understand the working of p-n junction diode as rectifier (half-wave and full-wave rectifier).

LIST OF PRACTICALS

- 1) A.C. and D.C. power supply with examples, single phase and poly phase power supply, switches, fuses
- 2) Heating effect of current, Ammeter, voltmeter, Galvanometer.
- 3) TLD badges and their uses and relative merits.
- 4) Rectifiers: Introduction, energy bands in solids, the semiconductor, p-type and n-type semiconductors, density of charge carriers and conductivity, p-n junction, p-n junction diode,
- 5) p-n junction diode as rectifier (half- wave and full-wave rectifier)

Conventional Radiography and Equipment Practical

Course Code	RDL111
Course Title	Conventional Radiography and Equipment Practical
Type of Course	Practical
LTP	0.0.3
Credits	1.5
Course Prerequisites	10+2(Science)
Course Objectives(CO)	CO1:The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. CO2:Understanding the image intensifier, its features, spot film. CO3:Knowledge about Grids, its features & types. CO4:Know about effects of Kv and mAs. CO5:Understand the Maintenance of x-ray equipment and accessories.

LIST OF PRACTICALS

1. X-ray tube, its features &Parts
2. Image intensifier, its features, spot film.
3. Grids, its features &types
4. Effects of kV and mAs
5. Maintenance of X-ray equipment and accessories.

Radiographic and Image Processing Techniques Practical

Course Code	RDL115
Course Title	Radiographic and Image Processing Techniques Practical
Type of Course	Practical
LTP	0.0.3
Credits	1.5
Course pre-requisite	10+2(Science)
Course Objectives	CO1:The purpose of this course to know composition of film, screens, cassette, processing solution, the usage and effect of light. CO2:Perform best storage guidelines for film storage and handling. Select cassette size, Loading & unloading of films. CO3:Introduction to Loading and unloading of films CO4:Study about Maintenance of processing tank. CO5:Knowledge about Safe light test.

LIST OF PRACTICALS

In Dark Room

- 1-Loading and unloading of films
- 2-Cassette handling
- 3-Preparation of developer
- 4-Preparation of fixer
- 5-Maintenance of processing tank
- 6-Developing methods
- 7-Safe lights

Communication skills-I

Course Code	ENG121
Course Title	Communication skills-I
Type of course	Theory
L T P	2:0:0
Credits	2
Course prerequisite	+2 in any stream
Course Objective (CO)	Objectives of the course is to: <ol style="list-style-type: none"> 1. Equip the learner with proficiency in reading comprehension.. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcomes	At the conclusion of the course the learner will be able to: <ol style="list-style-type: none"> 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and command in official/ corporate communication. 3. Develop confidence in making presentation: oral or documentary.

UNIT-I

Basics of Communication Skills: Communication, Process of Communication, Types of Communication-Verbal and Non verbal communication, Channels of Communication- Upward, Downward, Horizontal, Barriers to Communication, Role of Communication in society.

UNIT-II

Listening Skills: Listening Process, Hearing and Listening, Types of Listening, Effective Listening, Barriers of Effective Listening, Note Taking

Reading Skills: Purpose of reading, Process of reading, reading skills Models and strategies, scanning, skimming, SQ3R, Approaches of Reading, Comprehension passages for practice.

UNIT III

Writing Skills: Purpose of writing, Effective writing, Types of writing, Business Correspondence, Precise writing, Memo writing, minutes of meeting.

UNIT-IV

Speaking Skills: Speech process, Skills of effective speaking, Role of audience, Feedback Skill, Oral Presentation.

Recommended Books:

Sr No	Author(s)	Title	Publisher
1.	Bhupender Kour	Effectual Communication Skills	S.K. Kataria and Sons
2.	R. Datta Roy and K.K. Dheer	Communications Skills	Vishal Publishing Company
3	The Essence of Effective Communication	Ludlow and Panton	Prentice Hall of India
4	Essentials of Business Communication	Pal and Korlahalli	S. Chand and Sons. New Delhi

Communication Skills-1 Practical

Course Code	ENG123
Course Title	Communication Skills-1 Practical
Type of Course	HS
L T P	0:0:2
Credits	1
Course pre-requisite	+2 in any stream
Course Objectives	Objectives of the course is to: 1. Equip the learner with proficiency in reading comprehension.. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcomes	At the conclusion of the course the learner will be able to: 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and have command in official/ corporate communication. 3. Develop confidence in making presentation; oral or documentary.

UNIT-I

Speaking and Discussion Skills: Oral Presentation, Planning and organizing content for presentation, Use of audio /Visual Aids, Making Slides for presentation , Group Discussion ,Debate, Extempore speaking, Interview Skills, Mock interview, Mock Dialogues (Pair Speaking), Cue Card Speaking, Meeting/ Conferences.

UNIT-II

Listening Skills: Listening to any recoded material and asking oral/written questions for listening comprehension.

Reading Skills: Active Reading of passages for Reading comprehensions, paraphrase, Summary writing.

UNIT-III

Writing Skills: Guidelines of effective writing, Paragraph Writing, Email Writing.

UNIT-IV

Grammar and Vocabulary:

Parts of Speech, Tenses, GRE words (List of 50 Words).

Recommended Books:

Sr No	Author(s)	Title	Publisher
1.	Bhupender Kour	Effectual Communication Skills	S.K. Kataria and Sons
2.	R. Datta Roy and K.K. Dheer	Communications Skills	Vishal Publishing Company
3	The Essence of Effective Communication	Ludlow and Panton	Prentice Hall of India
4	Essentials of Business Communication	Pal and Korlahalli	S. Chand and Sons. New Delhi

SECOND
SEMESTER

Human Anatomy & Physiology-II

Course Code	RDL102
Course Title	Human Anatomy & Physiology-II
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc. RDL-I
Course objective	Students will learn the concepts of anatomical structures in relationship to their physiological functions. They will also learn the integration and coordination of body functions and their dependence on endocrine and nervous system to regulate the physiological activities.
Course Outcome	<ul style="list-style-type: none"> • Understand the homeostatic mechanisms and altered physiology of Nervous system. • Understand the homeostatic mechanisms and altered physiology of endocrine and urinary system • Understand the homeostatic mechanisms and altered physiology of reproductive system.

UNIT-I

Urinary System: Parts, Gross structure of kidney, ureters, urinary bladder and urethra, structure of nephron, measurement and regulation of GFR and mechanism of urine formation.

UNIT-II

Reproductive System: Parts of the system, gross structure of both male and female reproductive organs, reproductive cycle in female including menstrual cycle, pregnancy, parturition, lactation, male sex hormones and spermatogenesis and Basis of contraception.

UNIT-III

Nervous System: Structure of neuroglia and neurons, nerve impulse, myelinated and non-myelinated nerve parts and classification:

- CNS – Structure of Brain and spinal cord and their functions.
- PNS - Cranial nerves and spinal nerves
- ANS - Sympathetic and Parasympathetic

Brief account of resting membrane potential, action potential and conduction of nerve impulse across synapse and neuromuscular junction and role of neurotransmitters

Sensory Organs: Structure and functions of Skin, Eye, Nose, Ear and Tongue (Auditory and Olfactory apparatus)

UNIT-IV

Endocrine System: Gross structure of pituitary, thyroid, parathyroid, pancreas and adrenal glands, Names of endocrine glands - their secretions and functions, Brief account of endocrine disorders.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Anatomy & Physiology- Ross and Wilson	Anne Waugh & Allison Grant	Churchill Living Stone
2	Anatomy and Physiology: Understanding the Human Body	Robert Clark	Jones & Bartlett publishers
3	Anatomy and Physiology for nurses	Evelyn Pearce	Faber & Faber
4.	Functional Histology	James S. lowe, Barbara young, Allen Stevens & John W heath	Elsevier
5.	Text book of human Histology with color Atlas and Practical Guide	Inderjit singh	Jaypee Brothers Medical publishers
6.	Understanding Human Anatomy and Physiology	William Davis	Mc Graw Hill

Clinical Radiography-Positioning Part I

Course Code	RDL106
Course Title	Clinical Radiography-Positioning Part I
Type of Course	Theory
LTP	3.0.0
Credits	3
Course pre-requisite	10+2
Course Objectives	CO1:This course is designed to provide the students the basic knowledge in Radiography. CO2:Study about lower limb–x-ray positioning. CO3:Under standing about various vertebral column-curves, postures, at lantooccipital region, cervical spine- cervic thoracic spine, thoracic spine, lumbar spine sacrum, coccyx CO4:Know about bones of thorax. CO5:Study about of tissue radiography

UNIT I

Upper limb–x-ray positioning of Fingers individuals and as a whole hands, carpal tunnel, wrists, forearm, humerus, shoulder joint, clavicle. basic views.

UNIT II

Lower limb –x-ray positioning of toes, foot, calcaneus, ankle joint, leg, knee joint, patella femur, x-ray positioning of Hip and pelvis Chest including thoracic cage and sternum.

UNIT III- Vertebral column -curves, postures, atlanto-occipital region, cervical spine -cervico thoracic spine, thoracic spine, lumbar spine sacrum, coccyx

UNIT IV-Bones of thorax–Sternum anatomy sternum projections, Ribs projections ribs anatomy

Fractures of upper limb, lower limb, vertebral column and ribs

Soft tissue radiography : Larynx, pharynx, nasopharynx, thoracic inlet

RECOMMENDED BOOKS

S. No.	Author(s)	Title	Publisher
1	Clark	Radiography Positioning	
2	O P Sharma	Radiology Of Positioning For Technician	

Modern Radiological & Imaging equipment Including Physics

Course Code	RDL110
Course Title	Modern Radiological & Imaging equipment Including Physics
Type of Course	Theory
L T P	3.0.0
Credits	3
Course Prerequisites	10+2
Course Objectives (CO)	CO1: The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications of mammography and computed radiography. CO2: Knowledge about Special equipment, Portable and mobile x-ray. CO3: Study About CT-Basic physics. CO4: Study about Computed radiography & Digital Radiography. CO5: Study about Equipment for Dental Radiography.

UNIT I

Mammography, History of mammography, Mammographic equipment, Mammographic radiation dose and exposure. Dedicated mammographic unit and its special features, Types of mammograph Routine Mammographic Positioning & Views with additional views and technical considerations.

UNIT II

Special equipment: Portable and mobile x-ray units, Generator, x-ray tubes; Accessories; Resolution, Advantages & Disadvantages of Portable and mobile x-ray unit.

UNIT III

CT - Basic physics – Tomography principle, CT instrumentation, imaging system, computer system, image display, recording, storage and communication system.

UNIT IV

Computed radiography: its principle, physics & equipment. Digital Radiography. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications.

Equipment for Dental Radiography: Intra oral radiography unit, the orthopantomograph unit (OPG)

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	K Thayalan	The Physics Of Radiographic Equipments	

Contrast and Special Radiography Procedures

Course Code	RDL114
Course Title	Contrast and Special Radiography Procedures
Type of Course	Theory
L T P	3-0-0
Credits	3
Course Prerequisites	10+2
Course Objectives (CO)	CO1: This course is designed to provide the students the basic knowledge in systematic investigations with using contrast media and image intensifier. CO2: Knowledge about Contrast Media and Patient Management Emergency Drugs in the Radiology Department. CO3: Study About Fluoroscopy, general considerations. CO4: Study about Biliary system Investigations.

UNIT I

Special radiographic procedures Responsibility of Radiographer during Radiological Procedures. Preparation of Patient for Different Procedures.

UNIT II

Contrast Media - Positive and Negative, Ionic & Non – Ionic Adverse Reactions To Contrast Media and Patient Management Emergency Drugs in the Radiology Department Emergency Equipment's In the Radiology Department, Aseptic technique Indications, contraindications, basic techniques and relationship to other techniques of the following special procedures .

UNIT III

Gastrointestinal Tract: Fluoroscopy, general considerations, responsibility of radiographers, Barium swallow, pharynx and esophagus, 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 Water soluble contrast media - eg. gastrograffin studies b. Salivary glands: Routine technique, procedure – sialography c.

UNIT IV

Biliary system: Plain film radiography Intravenous cholangiography Percutaneous cholangiography. Endoscopic retrograde cholangio-pancreatography (ERCP) Operative cholangiography Post-Operative cholangiography (T - tube Cholangiography).

Urinary system: Intravenous urography, Retrograde pyelography, Antegrade pyelography Cystography and micturating cystourethrography Urethrography (ascending), Renal puncture. Female reproductive system: Hysterosalpingography.

Respiratory system: Bronchography: Awareness. h. Sinusography: Routine technique and procedure.

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	Dr. Bushan N Lakhar	Radiological Procedures	ARYAN

Communication Skills-II

Course Title	Communication Skills-II
Type of Course	Theory
LTP	2:0:0
Credits	2
Course pre-requisite	+2 in any stream
Course Objectives (CO)	Objectives of the course is to: <ol style="list-style-type: none"> 1. Equip the learner with proficiency in reading comprehension.. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcomes	At the conclusion of the course the learner will be able to: <ol style="list-style-type: none"> 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and have command in official/ corporate communication. 3. Develop confidence in making presentation; oral or documentary.

UNIT-I

Grammar: Parts of Speech, Use of appropriate tense, Voice , Reported Speech, Sentence Structure; Simple, Compound, Complex, Vocabulary-One word substitution.

UNIT-II

Writing Skills: Application for employment , Resume Writing ,Paragraph Writing Construction-Kinds of Paragraphs, Preparing of Matter for meeting : Notice, agenda, Conference

UNIT-III

Speaking Skills: Effective oral Presentation, Slide making, Use of audio Visual aids.

UNIT-IV

Oral Communication and its Application:

Group Discussion, Customer Care Relations (PR Skills), Interview Skills (Conducting and appearing for interviews), and Telephone handling manners.

Recommended Books

S.No	Name	Author(s)	Publisher
1	Business Communication	K. K. Sinha	Galgotia Publishing Company.
2	Media and Communication Management	C. S. Rayudu	- Himalaya Publishing House,
3	Essentials of Business Communication	Rajendra Pal and J. S. Korlahalli	Sultan Chand & Sons, New Delhi

Human Anatomy & Physiology-II Practical

Course Code	RDL104
Course Title	Human Anatomy & Physiology-II Practical
Type of Course	Practical
L T P	0 0 2
Credits	1
Course prerequisite	B.Sc RDL I
Course objective	The concepts related to anatomical details of human organ systems and integration and coordination between them will be demonstrated through charts, models and permanent slides.
Course Outcome	<ul style="list-style-type: none"> • Students understand the basic components of anatomy & physiology of animals with special reference to human beings. • Make aware the students to understand and learn about :various tissue systems and organ systems in animals . • Explain the gross morphology, structure and functions of various organs of the human body

List of Experiments

1. Study of following body systems showing all parts through charts and models
 - a) Excretory system: kidney, ureters and urinary bladder
 - b) Male reproductive system: Testes and vas deferens
 - c) Female reproductive system: ovaries, uterus, fallopian tubes
 - d) Nervous system: parts of brain; cerebellum, cerebrum, Pons and medulla oblongata
2. Study of histology of following tissues and organs from permanent slides:
 - Kidney (LS)
 - T.S of cortex part of kidney
 - T.S of medulla part of kidney
 - T.S of testes
 - T.S of ovaries
 - myelinated and non-myelinated nerve fibres
 - T.S of spinal cord
 - Thyroid gland (TS)
 - Adrenal gland (TS)
 - Pancreas (TS)
3. Study of structure of various sensory organs from charts.
4. Eye
5. Ear
6. Nose

Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos

Clinical Radiography-Positioning Part I laboratory

CourseCode	RDL108
CourseTitle	Clinical Radiography-Positioning Part I laboratory
TypeofCourse	Practical
LTP	0-0-3
Credits	1.5
CoursePrerequisites	10+2
CourseObjectives(CO)	CO1:This course is designed to provide the students the basic knowledge in Radiography. CO2:Know About Upper limb radiography CO3:UnderstandingtheLowerlimbradiography. CO4:Knowledge about Spinal radiography CO5:Know about various soft tissue larynx, Larynx, pharynx

LIST OF PRACTICALS

- **Performed Regional radiography-**
 - a. Upper limb radiography
 - b. Lower limb radiography
 - c. Spinal radiography
 - d. Soft tissue larynx, Larynx, pharynx, nasopharynx,

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	Clark	Radiography Positioning	
2	O P Sharma	Radiology Of Positioning For Technician	

Modern Radiological & Imaging equipment Including Physics Practical

Course Code	RDL112
Course Title	Modern Radiological & Imaging equipment Including Physics Practical
Type of Course	Practical
L T P	0.0.3
Credits	1.5
Course Prerequisites	10+2
Course Objectives (CO)	CO1:The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications of mammography and computed radiography. CO2: Know about portable X-Ray Equipment. CO3: Study about Mammography X-Ray tube CO4: Study about Dental X-Ray unit. CO5:Knowledge about Computed Tomography Parts

LIST OF PRACTICALS

- Portable X-Ray Equipment.
- Mammography X-Ray tube
- Dental X-Ray unit.
- Computed Tomography Parts

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	Dr.S.K.Bhargava	Radiology For Residents And Tecnicians	CBS
2	K Thayalan	The Physics Of Radiology And Imaging	

Contrast and Special Radiography Procedures Practical

Course Code	RDL116
Course Title	Contrast and Special Radiography Procedures Practical
Type of Course	Theory
L T P	0-0-3
Credits	1.5
Course Prerequisites	10+2
Course Objectives (CO)	CO1: This course is designed to provide the student the basic knowledge in systematic investigations with using contrast media and image intensifier. CO2: Know about Radiography in various positions for all the special radiological procedures, using contrast media. CO3: Identification of various films for all the special radiological procedures, using contrast media and related pathologies

LIST OF PRACTICALS

- Radiography in various positions for all the special radiological procedures, using contrast media
- Identification of various films for all the special radiological procedures, using contrast media and related pathologies

Books Recommended

S. No.	Author(s)	Title	Publisher
1	Dr. Kushal Gehlot	A Guide On Special Radiographic Investigations & Techniques	
2	Chapman	Special Investigations	

Communication Skills-II Practical

Course Code	ENG116
Course Title	Communication Skills-II Practical
Type of Course	Practical
L T P	0:0:2
Credits	1
Course pre-requisite	+ 2 with any stream
Course Objectives	Objectives of the course is to: <ol style="list-style-type: none"> 1. Equip the learner with proficiency in reading comprehension.. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcomes	At the conclusion of the course the learner will be able to: <ol style="list-style-type: none"> 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and have command in official/ corporate communication. 3. Develop confidence in making presentation; oral or documentary.

UNIT-I

Grammar:

To recognize part of speech of particular word in given sentence, To use appropriate tense , Exercise on- Voice, Reported speech and Sentence Structure, Vocabulary-One word substitution.

UNIT-II

Writing Skills:

Job Application, Resume Writing, Paragraph Writing, Preparing of Matter for meeting: Notice, agenda, Conference.

UNIT- III

Speaking Skills: How to deliver an effective power point Presentation, Slide making, Effective use of audio Visual aids,

UNIT-IV

Oral Communication and its Application:

Group Discussion, Mock Interview (Conducting and appearing for interviews), and Role plays. Conducting a successful official meeting.

Recommended Books

S. No	Name	Author(s)	Publisher
1	Business Communication	K. K. Sinha	Galgotia Publishing Company,
2	Media and Communication Management	C. S. Rayudu	Himalaya Publishing House,
3	Essentials of Business Communication	Rajendra Pal and J. S. Korlahalli	Sultan Chand & Sons, New Delhi

**THIRD
SEMESTER**

Physics of Newer Imaging Modalities

Course Code	RDL201
Course Title	Physics of Newer Imaging Modalities
Type of Course	Theory
L T P	3-0-0
Credits	3
Course Objectives	<p>CO1: This course is designed to provide the students the basic knowledge in Radiography with using newer modalities of radiology. At the end of the course, the students should be able to know about Computed Tomography, Generation of CT Scanner.</p> <p>CO2: Study about Scanning principle, Image acquisition, Image reconstruction, Image manipulation, Image display and documentation</p> <p>CO3: Knowledge about CT Artifacts- Classification, Types, Causes</p> <p>CO4: Knowledge about CT scan studies acquisition/ protocols / techniques.</p> <p>CO5: Study & Knowledge about Patient preparation, Imaging techniques and protocols for- CT Angio, Brain, C.T Enteroclysis/ CT IVP/ dual phase CT, CT Guided FNAC/ biopsy</p>

UNIT I

Basic principle of CT scan, history of CT Scan, EMI, advantages and disadvantages, Equipment description, CT image quality, CT image display Advanced Computed Tomography Helical CT scan: Slip ring technology.

UNIT II

Scanning principle, Image acquisition, Image reconstruction, Image manipulation, Image display and documentation, Scanning parameters, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR.

UNIT III

CT Artifacts- Classification, Types, Causes, , Diagnostic aspects of CT and post Processing Techniques HRCT.

UNIT IV

CT scan studies acquisition/ protocols / techniques: CT of head and neck – thorax – abdomen – pelvis – musculo skeletal system – spine – PNS. 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.

UNIT V

CT procedures: patient preparation, Imaging techniques and protocols for- CT Angio mainly Brain, C.T Enteroclysis/ CT IVP/ dual phase CT, CT Guided FNAC / biopsy

S.No.	Author(s)	Title	Publisher
1	Dr bushan n lakhar	Radiological procedures	Aryan
2	K thayalan	The physics of radiology and imaging	

CourseCode	RDL203
Course Title	Physics of Newer Imaging Modalities Practical
Type of Course	Practical
L T P	0-0-3
Credits	1.5
Coursepre-requisite	10+2
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography with using newer modalities of radiology. At the end of the course, the student should be able to know about ultra sonography Computed Tomography, Generation of CT Scanner, Magnetic resonance imaging, fusion imaging PET, Contrast media using, handling and tele radiology.

LIST OF PRACTICALS

- Physics, scanning principle and image formation in CT
- Identification of different parts of CT scanner
- Applications of various procedures in well-equipped Hospitals and Diagnostic Centers
- **Quality control of CT**

Books Recommended-

S.No.	Author(s)	Title	Publisher
1	Dr.S.K Bhargava	CT & MRI Protocol	
2	K Thayalan	The Physics Of Radiology And Imaging	

Clinical Radiography-Positioning Part II

Course Code	RDL205
Course Title	Clinical Radiography-Positioning Part II
Type of Course	Core
L T P	3-0-0
Credits	3
Coursepre-requisite	10+2
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography.

UNIT-I Radiography technique comprising of the complete. Radiography of Skull and Radiography of cranial bones; including special techniques for Sella turcica, orbits, optic foramina, superior orbital fissure and inferior orbital fissure etc. Facial bones; Paranasal sinuses, Temporal bone and Mastoids.

UNIT II- Dental Radiography: Radiography of teeth-intra oral, extra oral and occlusal view.

UNIT III- Abdomen: Preparation of patient. General abdominal radiography and positioning for fluid and air levels. Plain film examination. Radiography of female abdomen to look for pregnancy. Radiography in case of acute abdomen.

UNIT IV-High KV techniques principle and its applications. Soft tissue Radiography. Localization of foreign bodies. Various techniques Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography.

Macro radiography: Principle, advantage, technique and applications. Stereography - Procedure - presentation, for viewing, stereoscopes, stereometry.

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	CLARK	Radiography positioning	
2	O P SHARMA	Radiology of positioning for technician	

Clinical Radiography-Positioning Part II Practical

Course Code	RDL207
Course Title	Clinical Radiography-Positioning Part II Practical
Type of Course	Practical
L T P	0.0.3
Credits	1.5
Coursepre-requisite	10+2
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography.

LIST OF PRACTICALS

- All views and techniques Abdomen: Gastro-intestinal tract , urinary tract
- Skeletal Survey.

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	Clark	Radiography Positioning	
2	O P Sharma	Radiology Of Positioning For Technician	

[.www.wikipedia.co.in//www.radiopedia.co.in](http://www.wikipedia.co.in/www.radiopedia.co.in)

Newer Modalities Imaging Techniques Including Patient Care

Course Code	RDL209
Course Title	Newer Modalities Imaging Techniques Including Patient Care
Type of Course	Theory
L T P	3.0.0
Credits	3
Coursepre-requisite	10+2
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography with patient care and code of ethics

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

UNIT II- Diagnostic procedure angiography, angioplasty, biliary examination, renal evaluation and drainage procedure. Central Nervous System: a. Myelography b. Cerebral studies c. Ventriculography Arthrography: Shoulder, Hip, Knee, Elbow

UNIT III-- Diagnostic procedure 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. Angiocardiology

UNIT IV- Diagnostic procedure Venography: a. Peripheral venography b. Cerebral venography c. Inferior and superior venocavography d. Relevant visceral phlebography

Diagnostic procedure Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophysiology.

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	Mauro Moscucci	Cardiac Catheterization, Angiography, And Intervention	

www.wikipedia.co.in

www.radiopedia.co.in

Newer Modalities Imaging Techniques Including Patient Care Practical

Course Code	RDL211
Course Title	Newer Modalities Imaging Techniques Including Patient Care Practical
Type of Course	Practical
L T P	0-0-3
Credits	1.5
Coursepre-requisite	10+2
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography with patient care and code of ethics

LIST OF PRACTICAL

- Medical records and documentation
- Legal issues in radiology department, PNDT Act
- Professional ethics and Code of conduct of radiographer
- Local anesthesia and general anesthesia
- Facilities regarding general Anesthesia in the X-ray department
- Management of adverse reactions to contrast media

Quality Control in Radiology and Radiation Safety

Course Code	RDL213
Course Title	Quality Control in Radiology and Radiation Safety
Type of Course	Core
L T P	3.0.0
Credits	3
Coursepre-requisite	10+2
Course Objectives	This course is designed to provide the students the basic knowledge in Radiation protection,Biological effects of radiation,Planning of radiation installation-protection primary & secondary radiation and Personnel monitoring systems

UNIT I-Radiation protection,Natural and background radiation (cosmic, terrestrial),Principles of radiation protection,Time - distance and shielding, shielding calculation and radiation survey, Personnel dosimeters (TLD and film batches), occupational exposure, radiation protection of self and patient, ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection,Revision of Somatic & Genetic Radiation effects, Units Detection & measurements Radiation protection Standards, radiation surveys & regulations. Patient Protection

UNIT II-Biological effects of Ionizing Radiatin,Ionization, excitation and free radical formation, hydrolysis of water, Action of radiation on cell, DNA, RNA, chromosome, tissue and organ, cytoplasm, cellular membranes, effects of whole body and acute irradiation.

UNIT III- Dose fractionation. Effects of ionizing radiation on each of major organ system including fetus stochastic and non-stochastic effects. Mean and lethal dose, direct and indirect effects, multi target and multi hit theory, stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radio sensitivity

UNIT IV- Measuring systems – free air ionization chamber – thimble ion chamber – condenser chamber – Secondary standard dosimeters – film dosimeter – chemical dosimeter-Thermoluminescent Dosimeter. -Pocket dosimeter Radiation survey meter- wide range survey meter -zone monitor-contamination monitor their principle function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement..

UNIT V- Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	DR.S.K BHARGAVA	CT & MRI PROTOCOL	
2	K THAYALAN	THE PHYSICS OF RADIOLOGY AND IMAGING	

Basics of Computers Practical

Course Code	CSE213
Course Title	Basics of Computers Practical
Type of course	Practical
L T P	0 0 3
Credits	1.5
Course prerequisite	NA
Course Objective (CO)	
Course Outcome	<p>II. Bridge the fundamental concepts of computers with the present level of knowledge of the students</p> <p>III. Familiarize operating systems, programming languages, peripheral devices, networking, multimedia and internet</p> <p>IV. Understand binary, hexadecimal and octal number systems and their arithmetic</p>

List of practicals

1. Given a PC, name its various components and peripherals. List their functions
2. Practice in installing a computer system by giving connection and loading the system software and application software
3. Exercises on entering text and data (Typing Practice)
4. **Installation of operating System viz. Windows XP, Windows 2007 etc.**

Features of Windows as an operating system

 - Start
 - Shutdown and restore
 - Creating and operating on the icons
 - Opening closing and sizing the windows
 - Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file
 - Creating and operating on a folder
 - Changing setting like, date, time, colour (back ground and fore ground)
 - Using short cuts
 - Using on line help
5. **Word Processing (MS Office/Open Office)**
 - a) File Management:
 - Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file
 - b) Page Set up:
 - Setting margins, tab setting, ruler, indenting
 - c) Editing a document:
 - Entering text, Cut, copy, paste using tool- bars
 - d) Formatting a document:

Using different fonts, changing font size and colour, changing the appearance through bold/ italic/ underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods

Aligning of text in a document, justification of document, Inserting bullets and numbering

Formatting paragraph, inserting page breaks and column breaks, line spacing

Use of headers, footers: Inserting footnote, end note, use of comments

Inserting date, time, special symbols, importing graphic images, drawing tools

e) Tables and Borders:

Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table

Print preview, zoom, page set up, printing options

Using Find, Replace options

f) Using Tools like:

Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels

Using shapes and drawing toolbar,

Working with more than one window in MS Word,

How to change the version of the document from one window OS to another

Conversion between different text editors, software and MS word

6. Spread Sheet Processing (MS Office/Open Office)

a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, create chart, printing chart, save worksheet, switching between different spread sheets

b) Menu commands:

Create, format charts, organise, manage data, solving problem by analyzing data, exchange with other applications. Programming with Excel Work Sheet, getting information while working

c) Work books:

Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations, working with arrays

4. Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet

5. Creating a chart:

6. Working with chart types, changing data in chart, formatting a chart, use chart to analyze data

7. Using a list to organize data, sorting and filtering data in list

8. Retrieve data with query: Create a pivot table, customising a pivot table. Statistical

9. analysis of data

10. Exchange data with other application: embedding objects, linking to other applications, import, export document.

7. PowerPoint Presentation (MS Office/Open Office)

a) Introduction to PowerPoint

- How to start PowerPoint
- Working environment: concept of toolbars, slide layout, templates etc.
- Opening a new/existing presentation
- Different views for viewing slides in a presentation: normal, slide sorter etc.

- b) Addition, deletion and saving of slides
- c) Insertion of multimedia elements
 - Adding text boxes
 - Adding/importing pictures
 - Adding movies and sound
 - Adding tables and charts etc.
 - Adding organizational chart
- d) Formatting slides
 - Using slide master
 - Text formatting
 - Changing slide layout
 - Changing slide colour scheme
 - Changing background
 - Applying design template
- e) How to view the slide show?
 - Viewing the presentation using slide navigator
 - Slide transition
 - Animation effects etc.

8. Working with Data Processing (MS Office/Open Office)

- a) Understanding different data types
- b) Creation of table
- c) Entering data in a table and modify it.
- d) Creating simple Queries

9. Internet and its Applications

- a) Log-in to internet
- b) Navigation for information seeking on internet
- c) Browsing and down loading of information from internet
- d) Sending and receiving e-mail
 - Creating a message
 - Creating an address book
 - Attaching a file with e-mail message
 - Receiving a message
 - Deleting a message

Environmental Science

Course Code	EVS001
Course Title	Environmental Science
Type of course	Theory
L T P	3 0 0
Credits	3
Course prerequisite	NA
Course objective	To connect and sensitize the students towards the environment and prevailing environmental issues (natural, physical, social and cultural).
Course Outcome	<ul style="list-style-type: none"> • An Environmental Studies major will Prepare students to critically examine all sides of environmental issues and apply understanding from disciplines such as history, economics, psychology, law, literature, politics, sociology, philosophy, and religion to create informed opinions about how to interact with the environment on both a personal and a social level. • Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales. • Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

UNIT I

Introduction: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

Natural Resources: Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

Ecosystems: Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity

UNIT II

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution, Pollution case studies, Disaster Management: Floods, earthquake, cyclone and landslides.

UNIT III

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation.

Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

UNIT IV

Human Population and the Environment: Population growth, variation among nations. Population explosion –Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health.

Text and Reference Books:

S. No	Name	Author(S)	Publisher
1	Environmental Biology	Agarwal, K.C. 2001	Nidi Publ. Ltd. Bikaner.
2	Environmental Science	Miller T.G. Jr.	Wadsworth
3	Perspectives in Environmental Studies	Anubha Kaushik and Gaurav Garg	New Age International Publishers

First Aid

Course Code	MLS215
Course Title	First Aid
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	DSE
Course objective	To aware students regarding basic first aid techniques
Course Outcome	<ul style="list-style-type: none">• Learn about First-Aid for Respiratory & Cardiac Conditions.• Study about Wounds & Injuries & their Management & dressings.• Study about First Aid for Fractures, Dislocation & various neurological

UNIT I

First aid: Aims and objectives of first aid

Basic first aid techniques on Respiratory system & breathing

Cardiac condition, blood circulation & Shock

UNIT- II

Wounds & injuries

Dressing and bandages

Fractures & dislocation of the bone & joints.

Neurological conditions & unconsciousness

UNIT- III

Abnormality of the gastrointestinal tract & food poisoning

Electric shock; burns, hemorrhage.

UNIT- IV

Drug toxicity & poisoning, Bites & stings, Foreign body in ENT& Skin

Gender Equity

Course Code	SSC001
Course Title	Gender Equity
Type of course	ID
L T P	3:0:0
Credits	3
Course prerequisite	NA
Course Objectives (CO)	The students will be able to acquire knowledge and understanding of theory and concepts related to gender and gender relations The students will be able to critically reflect how gender is a development issue.
Course Outcome	The students will analyse the evolution of thinking and approaches around gender and development.

UNIT I

Concept of sex and gender
Gender attributes and questions of identity.

UNIT II

Empowerment- concept and meaning.
Definition of feminism, feminist and women movements in U.S.A, U.K., France and India

UNIT III

Women development and development organizations.
Impact of development on gender.

UNIT IV

Policies and current debates on women rights.
Role of UN in establishing gender equality.
Violence against women and need for reforms.

Text and Reference Books:

S.No.	Author(S)	Year	Title	Publisher
1	Jayachandran, Seema	2014	The Roots of Gender Inequality in Developing Countries	NBER Working Paper No.20380. Issued in August 2014
2	Duflo, Esther	2012	Women's Empowerment and Economic Development	<i>Journal of Economic Literature</i> , 50(4): 1051-79.

FOURTH SEMESTER

Cross Sectional Anatomy and Physiology

Course Code	RDL202
Course Title	Cross Sectional Anatomy and Physiology
Type of Course	Theory
L T P	3.0.0
Credits	3
Coursepre-requisite	10+2
Course Objectives	<p>CO1:To study about the identify cross-sectional anatomy in the sagittal,coronal and axial planes on CT and MR images.Describe anatomical structural relationships.Recognize normal anatomy and build a personal resource system for future study.</p> <p>CO2:LearnAnatomyoftheupperthorax.</p> <p>CO3:LearnCT/MRIImagesoftheThorax-Normalandpathologic.</p> <p>CO4:StudyaboutAnatomyofthePelvis-Bonystructuresandassociatedmuscles.</p>

UNIT I-Introduction to Sectional Anatomy & Terminology- Sectional planes,Anatomical relationships/terminology.

UNIT II

Anatomy of the upper thorax- Surface anatomy relationships, Bony structures and muscles, Blood vessels. Divisions of the mid-thorax, heart and great vessels- Lungs, heart and great vessels, Esophagus

UNIT III

CT/MRI Images of the Thorax - Normal and pathologic. Anatomy of the Abdomen- Major organs and their accessories, Abdominal blood vessels CT/MR Images of Abdomen - Normal and pathologic

UNIT IV

Anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems. Reproductive Organs CT/MR Images of the Male/Female Pelvis- Normal and pathologic. Neuro Anatomy- Scan planes.

Brain - Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves Spine- Vertebra and disc, Spinal cord and meninges Neck- Arterial/venous systems, Muscles, Glands and pharynx

Text Books:

S. No.	Author(s)	Title	Publisher
1	Weir & Abraham's	Imaging Atlas Of Human Anatomy	

Physics of Advanced Imaging Technology

Course Code	RDL206
Course Title	Physics of Advanced Imaging Technology
Type of Course	Theory
L T P	3.0.0
Credits	3
Course pre- requisite	10+2
Course Objectives	CO1: This course is designed to provide the student the basic knowledge in Magnetic resonance imaging investigations with using contrast media and imaging instrumentation, pulse sequences, bio-effects and safety in advance MRI CO2: Study about various MR Instrumentation & Types of magnets. CO3: Knowledge about MR Angiography – TOF & PCA CO4: Learn about Advanced technique & instrumentation of MRI.

UNIT I- History of MRI, Magnetism, Basic Principle, hardware, Types of Contrast agents used in MRI, Physical and physiological basis of magnetic relaxation, Image contrast and noise, Spin Echo, Inversion Recovery, Gradient Echo.

MR Instrumentation: Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers. d. Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP. e. MR contrast media –

UNIT III

MR Angiography – TOF & PCA – MR Spectroscopy – functional MRI, 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI.

UNIT IV

Advanced technique & instrumentation of MRI a. Basic Principles: Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image. b. 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

UNIT IV

MRI Scanners: Methods of MRI imaging methods – Brain and Neck ,Thorax, Abdomen, Knee, Spine - Clinical indications and contraindications, 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.

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	Govind B Chavhan	Mri Made Easy	

Radiographic Techniques of Advanced Imaging Technology

Course Code	RDL210
Course Title	Radiographic Techniques of Advanced Imaging Technology
Type of Course	Theory
L T P	3.0.0
Credits	3
Coursepre-requisite	10+2
Course Objectives	CO1:StudyaboutUltrasonography/Dopplerstudies. CO2:UnderstandingaboutInteractionofUSwithmatter. CO3::StudyaboutReal-timeultrasound. CO4:KnowledgeaboutTechniquesforimagingdifferentanatomicareas,ultrasound artifacts,biologicaleffectsandsafety. CO5:LearnaboutPatientpreparationforDoppler,Dopplerartifacts&vascularsonography

UNIT I

Ultrasonography/ Doppler studies: Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam, Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity.

UNIT II

Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing, . Ultrasound display modes: A, B, M .

UNIT III

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

UNIT IV-Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety.

Doppler Ultrasound- Patient preparation for Doppler, Doppler artifacts, vascular sonography

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	K Thayalan	The Physics Of Radiographic Equipments	

Regulatory Requirements in Diagnostic Radiology & Imaging, Act and Rules, Regulations for JCI, NABH, NABHR

Course Code	RDL214
Course Title	Regulatory Requirements in Diagnostic Radiology & Imaging, Act and Rules, Regulations for JCI, NABH, NABHR
Type of Course	Core
L T P	3-0-0
Credits	3
Coursepre-requisite	10+2
Course Objectives	CO1: TostudyabouttheAERBSafetyandEthics, KnowledgeaboutRegulatoryBodies®ulatoryRequirements. CO2: StudyaboutResponsibilitiesoflicenses, registrants&employersandEnforcementofRegulatoryrequirements. CO3: StudyaboutRoleofRadiographerinPlanning. CO4: StudyaboutPersonnelandareamonitoring. CO5: LearnaboutPlanningofX-rayrooms&darkrooms.

UNIT I-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,

UNIT II- Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements.

UNIT III- Role of Radiographer in Planning, QA & Radiation Protection: Role of technologist in radiology department.

UNIT IV- 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 rooms, dark rooms – Inspection of X-Ray installations - Registration of X-Ray equipment installation- Certification

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	K Thayalan	The Physics Of Radiographic Equipments	

Introduction to National Healthcare Delivery System in India

Course Code	MLS 222
Course Title	Introduction to National Healthcare Delivery System in India
Type of course	DSE
L T P	2 0 0
Credits	2
Course prerequisite	10+2
Course Objective (CO)	The course provides the students a basic insight into the main features of the Indian health care delivery system and how it compares with the other systems of the world.
Course Outcome	The students know about national policies

UNIT I : Introduction to healthcare delivery system

- Healthcare delivery system in India at primary, secondary and tertiary care
 - Community participation in healthcare delivery system
 - Health system in developed countries.
 - Private Sector
 - National Health Mission
 - National Health Policy
 - Issues in Health Care Delivery System in India
- National Health Programmes – Background objectives, action plan, targets, operations, achievements and constraints in various National Health Programmes.

UNIT II : Introduction to AYUSH system of medicine

- Introduction to Ayurveda
- Yoga and Naturopathy
- Unani
- Siddha
- Homeopathy
- Need for integration of various systems of medicine

UNIT III : Health scenario of India – past, present and future. Public health in India (epidemiology and demography)

Demography & Vital Statistics

- Demography – its concept
- Vital events of life & its impact on demography
- Significance and recording of vital statistics
- Census & its impact on health policy

UNIT IV : Epidemiology

- Principles of epidemiology
- Natural history of disease
- Methods of epidemiological studies
- Epidemiology of communicable & non-communicable diseases, disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance.

Medical Terminology

Course Code	RDL220
Course Title	Medical Terminology
Type of course	DSE
L T P	2 0 0
Credits	2
Course prerequisite	10+2
Course Objective (CO)	This subject introduces the elements of medical terminology
Course Outcome	The students know about <ul style="list-style-type: none">the terminology used by various domain doctors and practioners for the diagnosis, treatment of disease.

UNIT I

- A) Introduction to medical terminology
- B) Word formation & syntax
 - Greek alphabet
 - Greek & Latin prepositional & adverbial prefixes
 - Singular & plural endings
- C) Commonly used prefixes, suffixes and root words in medical terminology
- D) Common Latin term used in prescription writing
- E) Study of standard abbreviations
- F) Commonly used medical terms to define different parts of the body

UNIT II

Medical terminology used by: Cardiologist, Neurologist, Nephrologist, Gastro-intestinologist, ENT surgeon, Dentist, Orthopedic surgeon, Gynecologist, Oncologist, Dermatologist and Endocrinologist.

UNIT III

Medical record: Definition and Types of medical record, Importance of medical record, Flow chart of function, Statutory requirements of maintenance, coding, indexing and filing, Computerization of record, Report and returns by the record department, Statistical information and ICD.

UNIT IV

Utility & functions of Medical Records in Health care delivery System. Organizations & management of Medical Records Department, Role of Hospital managers & MRD personnel in Medical record keeping. Reports & returns in Medical Record System.

Basic knowledge of legal aspects of Medical Records including Factories Act, Workmen Compensation Act & Consumer Protection Act. Procedures of Medical Auditing & its importance, Government Regulations & requirements

Text Books:

S. No.	Author(s)	Title	Publisher
1	F.J. Baker & R.E. Silvert	An introduction to Med. Lab. Technology	Pb. London Butterworth and Co.Ltd.
2	B. M. Sakharkar	Principles of Hospital Administration & Planning	Jaypee Brothers
3	C. M.Francis	Hospital Administration	Jaypee Brothers
4	G.D. Mogli	Medical Records	Jaypee Brothers
5	Tabish	Hospital Administration	O.U.P.
6	C.M. Francis & D'Souza	Hospital Administration & Management	Jaypee Brothers
7	Goel& Kumar	Management of Hospitals	(Deep & Deep

Cross Sectional Anatomy and Physiology Practical

Course Code	RDL204
Course Title	Cross Sectional Anatomy and Physiology Practical
Type of Course	Practical
L T P	0.0.3
Credits	2
Coursepre-requisite	10+2
Course Objectives	CO1:To study about the identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR images. Describe anatomical structural relationships. Recognize normal anatomy and build a personal resources system for future study. CO2: Demonstration of dissected parts. CO3: Demonstration of skeleton-articulated and disarticulated. CO4: Know about Surface landmark-bony, muscular and

LIST OF PRACTICALS

- 1-Identification and description of all anatomical structures.
- 2-Demonstration of dissected parts
- 3-Demonstration of skeleton-articulated and disarticulated.
- 4-Surface anatomy: Surface land mark-bony, muscular and ligamentous. Surface anatomy of major nerves, arteries of the limbs.

Course References

1. PR Ashalatha & G Deepa's Textbook of anatomy & physiology
2. N Geetha 's Textbook of physiology

Reference Books:

S. No.	Author(s)	Title	Publisher
1	Weir & Abraham's	Imaging Atlas Of Human Anatomy	

Online references:

Coursera subscription for online anatomy topics

Radiographic Techniques of Advanced Imaging Technology Practical

Course Code	RDL212
Course Title	Radiographic Techniques of Advanced Imaging Technology Practical
Type of Course	Practical
L T P	0.0.3
Credits	2
Coursepre-requisite	10+2
Course Objectives	CO1: Know About Physics, scanning principle and image formation in USG CO2: Identification of different parts of USG scanner CO3: Applications of various procedures in well-equipped Hospitals and Diagnostic Centers . CO4: Quality control of USG.

LIST OF PRACTICALS

- Physics, scanning principle and image formation in USG
- Identification of different parts of USG scanner
- Applications of various procedures in well-equipped Hospitals and Diagnostic Centers
- Quality control of USG

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	K THAYALAN	THE PHYSICS OF RADIOGRAPHIC EQUIPMENTS	

**FIFTH
SEMESTER**

Quality Assurance & Radiation Safety (AERB Guidelines) in Diagnostic Radiology

Course Code	RDL301
Course Title	Quality Assurance & Radiation Safety (AERB Guidelines) in Diagnostic Radiology
Type of Course	Theory
LTP	3.0.0
Credits	3
Course pre-requisite	10+2
Course Objectives	CO1:The objective is to induce idea on quality assurance indifferent radiological modalities. CO2:Understand the Quality Assurance and quality control of Computed Tomography. CO3:Studying about Quality Assurance and quality control of Magnetic Resonance Imaging. CO4:Know About Quality Assurance and quality control of Ultrasonography. CO5:Study about the Image artifacts their different types, causes and remedies

UNIT I

Quality Assurance and quality control of Modern Radiological and Imaging Equipment Digital Radiography with Radiographic QA procedures, Daily Procedures, Weekly Procedures, Monthly Procedures.

UNIT II

Quality Assurance and quality control of Modern Radiological and Imaging Equipment Computed Tomography QA procedures, Daily Procedures, Weekly Procedures, Monthly Procedures.

Quality Assurance and quality control of Modern Radiological and Imaging Equipment Magnetic Resonance Imaging QA procedures, Daily Procedures, Weekly Procedures, Monthly Procedures.

UNIT III

Quality Assurance and quality control of Modern Radiological and Imaging Equipment Ultrasonography QA procedures, Daily Procedures, Weekly Procedures, Monthly Procedures.

UNIT IV

Image artifacts their different types, causes and remedies, Newer Radiation safety protocols and recent advances in radiation safety including AERB guidelines.

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	K Thayalan	The Physics Of Radiographic Equipments	

Hospital Practice & Care of Patients

Course Code	RDL305
Course Title	Hospital Practice & Care of Patients
Type of Course	Theory
L T P	3.0.0
Credits	3
Course pre-requisite	10+2
Course Objectives	<p>CO1:The objective is to learn to hospital staffing, Medical records and documentation and Understood the Legal issues, Professional ethics.</p> <p>CO2:Understanding Methods of effective communication.</p> <p>CO3:Know about various Elementary personal and departmental hygiene.</p> <p>CO4:Study about various types of Moving chair and stretcher.</p> <p>CO5:Study about Administration of drugs and contrast media.</p>

UNIT I-Hospital staffing and administration, records, professional, ethics, co-operation with other staff and departments, Departmental organisations. Handling of the patients, seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, drug addicts and non-English speaking patients. Understanding patient needs - patient dignity of inpatient and out patients. Interaction with the patient's relatives and visitors.

UNIT II- Methods of effective communication - verbal skills, body language, professional appearance, visual contact etc.

UNIT III- Elementary personal and departmental hygiene, dealing with receptacles, bed pans and urinaletc. General preliminaries to the exam.

UNIT IV- Moving chair and stretcher, patient. Unconscious patient, general comfort and reassurance for the patient. Vital signs and oxygen - patient's Hemostasis status. Body temp, respiratory rate, pulse, blood pressure, oxygen therapy, oxygen devices, Chest tubes and lines.

UNIT V-Administration of drugs and contrast media. Aseptic and sterile procedures. Handling of infections patients in the department or in the ward. Regulation of dangerous drugs. Trolley set up for special x-ray examinations **Books Recommended-**

S. No.	Author(s)	Title	Publisher
1	Ruth Ann Ehruch	Patient Care In Radiography	

Nuclear Medicine

Course Code	RDL309
Course Title	Nuclear Medicine
Type of Course	Theory
L T P	3.0.0
Credits	3
Coursepre-requisite	10+2
Course Objectives	CO1:The objective is to learn basics about the radioactivity and radioact ive nuclides. CO2:To Study about Production of Radionuclides Reactor produced ra dionuclide. CO3:To Study about Radiopharmacy & Handling & Transport of Radio- nuclides. CO4:To study about Safe handling of radioactive materials.CO5:Study about Equipment's of NMT..

UNIT I

Introduction to NMT and Radioactive Transformation Basic atomic and nuclear physics, History of radioactivity, Units & quantities, Isotopes, Isobars, Isomers, Radioactivity and half-life, Exponential decay, specific activity, Modes of Radioactive decay, parent daughter decay.

UNIT II

Production of Radio nuclides Reactor produced radionuclide, Reactor principles; Accelerator produced radionuclide, Radionuclide generators.

UNIT III

Radio pharmacy & Handling & Transport of Radio-nuclides Cold kits, Radio pharmacy used in Nuclear medicine, Radiopharmaceuticals used in various procedures.

UNIT IV

Safe handling of radioactive materials, Procedures for handling spills

UNIT V

Equipment's of NMT Gamma camera, PET, SPECT (working principle)

Recommended Books

S. No.	Author(s)	Title	Publisher
1	Cherry SR, Sorenson JA, Phelps ME	Cherry SR, Sorenson JA, Phelps ME	Elsevier Health Sciences
2	Bomford CK, Miller J, Kunkler H, Sherriff IH, Bomford SB, IH Kunkler SB. Walter and Miller's	Textbook of radiotherapy: radiation physics, therapy, and oncology	Elsevier Health Sciences
3	Waterstram-Rich KM, Gilmore D. Nuclear Medicine and PET/CT	Technology and Techniques	Elsevier Health Sciences

Research Methodology and Biostatistics

Course Code	RDL311
Course Title	Research Methodology and Biostatistics
Type of Course	Theory
L T P	3.0.0
Credits	3
Coursepre-requisite	10+2
Course Objectives (CO)	The objective of this module is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings. The students will also be made aware of the need of biostatistics and understanding of data, sampling methods, in addition to being given information about the relation between data and variables.

UNIT I

Introduction to research methods, Identifying research problem, Ethical issues in research, Research design, Basic Concepts of Biostatistics

UNIT II

Types of Data, Research tools and Data collection methods, sampling methods, developing a research proposal

UNIT III

Need of biostatistics, what is biostatistics: beyond definition, Understanding of data in biostatistics, how & where to get relevant data, Relation between data & variables, Type of variables: defining data set

UNIT IV

Collection of relevant data: sampling methods, Summarizing data on the pretext of underlined study, Understanding of statistical analysis (not methods)

Construction of study: population, sample, normality and its beyond (not design of study, perhaps)

RECOMMENDED BOOKS:

S. No.	Author(s)	Title
1	S. P. Gupta	Statistical Methods
2	B. K. Mahajan	Methods in biostatistics for medical students
3	HimanshuTyagi	RPG Biostatistics

Quality Assurance & Radiation Safety (AERB Guidelines) in Diagnostic Radiology Practical

Course Code	RDL303
Course Title	Quality Assurance & Radiation Safety (AERB Guidelines) in Diagnostic Radiology Practical
Type of Course	Practical
L T P	0.0.3
Credits	1.5
Coursepre-requisite	10+2
Course Objectives	The objective is to induce idea on quality assurance in different radiological modalities.

PRACTICAL OF PRACTICALS

Working on-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, Newer Radiation safetyprotocols and recent advances in radiation safety including AERB guidelines.

Hospital Practice & Care of Patients Practical

Course Code	RDL307
Course Title	Hospital Practice & Care of Patients Practical
Type of Course	Practical
L T P	0.0.4
Credits	2
Coursepre-requisite	10+2
Course Objectives	The objective is to learn to hospital staffing, Medical records and documentation and Understood the Legal issues, Professional ethics.

LIST OF PRACTICALS

- Medical records and documentation
- Legal issues in radiology department, PNDT Act
- Professional ethics and Code of conduct of radiographer
- Handling of patients: Seriously ill and traumatized patients, visually impaired, hearing and speech impaired patients, mentally impaired patients, infectious patients
- Departmental Safety
- Infection control: skin care, donning of gowns, gloves, face masks, head caps, shoe covers.
- Vitals signs
- Body mechanics and transferring of patient, draw sheet lift, use of slide boards, wheelchair to couch, couch to wheelchair, couch to table, three men lift and four men lift.
- Facilities regarding general Anesthesia in the X-ray department
- Management of adverse reactions to contrast media

Nuclear Medicine Practical

Course Code	RDL313
Course Title	Nuclear Medicine Practical
Type of Course	Practical
L T P	0.0.3
Credits	1.5
Coursepre-requisite	10+2
Course Objectives	The objective is to learn basics about the radioactivity and radioactive nuclides.

LIST OF PRACTICALS

Working on-

- Positron Emission Tomography
- Single Photon Emission Tomography
- Patient Preparation
- Indications

Generic Skills and Entrepreneurship Development

Course Code	COM317
Course Title	Generic Skills And Entrepreneurship Development
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	
Course Objective (CO)	This paper is aimed at developing employability skills and conceptual understanding among students for setting up one's own business venture/enterprise
Course Outcome	<ul style="list-style-type: none"> • Student will be able to explain the importance of generic skills • They can Manage himself/herself physically, intellectually and psychologically • They can Demonstrate self-development

UNIT-I

Introduction to Generic Skills -Importance of Generic Skill Development (GSD), Global and Local Scenario of GSD, Life Long Learning (LLL) and associated importance of GSD.

Leadership Skills: Managing in Team - Team definition, hierarchy, team dynamics, Team related skills-sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background, Communication in group -conversation and listening skills

UNIT-II

Task Management - Task Initiation, Task Planning, Task execution, Task close out, Exercises/case studies on task planning towards development of skills for task management

Problem Solving - requisites of problem solving-meaningful learning, ability to apply Knowledge in problem solving, different approaches for problem solving. Steps followed in problem solving, Exercises/case studies on problem solving.

UNIT-III

Entrepreneurship: Introduction, Concept/Meaning and its need, Competencies/qualities of an entrepreneur, Entrepreneurial Support System e.g., District Industry Centers (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

UNIT- IV

Market Survey and Opportunity Identification (Business Planning)

- How to start a small scale industry
- Procedures for registration of small-scale industry
- List of items reserved for exclusive manufacture in small -scale industry
- Understanding business opportunity

SIXTH SEMESTER

Internship and Dissertation

Course Code	RDL302
Course Title	Internship and Dissertation
Type of Course	Practical
L T P	0.0.30
Credits	15
Coursepre-requisite	10+2

INTERNSHIP/DISSERTATION

Students have to carry out a research project (on any topic related to radiology) under the supervision

of a faculty/hospital administration. The project report has to be prepared on the basis of the research work carried out. The assessment is done on the basis of the work done and the presentation and viva.

INTERNSHIP SCHEDULE-

S.No.	Postings	Duration
1	Conventional Radiography/Digital Radiography	1 Month
2	Radiographic Special Procedures	1 Month
3	Ultrasound	1 Month
4	Computed Tomography	1 Month
5	Magnetic Resonance Imaging	1 Month
6	Nuclear Medicine	1 Month