Total Credits = 24

Semester 3rd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	L	T	P	Int.	Ext.	Total	
BRMIS1-301	Anatomy, Physiology, Pathology and Pharmacology related to Radiology – Theory	3	1	0	40	60	100	4
BRMIS1-302	Radiological Physics and Dark Room Techniques Theory	3	1	0	40	60	100	4
BRMIS1-303	General Radiology- Positioning Theory	3	1	0	40	60	100	4
BRMIS1-304	Fundamentals of Radio Imaging Technology	3	1	0	40	60	100	4
BRMIS1-305	Biostatics and Computer Application	1	1	0	40	60	100	2
BRMIS1-306	Basic Principles of Hospital Management	1	1	0	40	60	100	2
BRMIS1-307	Anatomy, Physiology, Pathology and Pharmacology related to Radiology- Practical	0	0	2	60	40	100	1
BRMIS1-308	Radiological Physics and Dark Room Techniques Practical Comprehensive viva	0	0	2	60	40	100	1
BRMIS1-309	General Radiology- Positioning - Practical	0	0	2	60	40	100	1
BRMIS1-310	Fundamentals of Radio Imaging Technology - Practical	0	0	2	60	40	100	1
Total		**-**	**-**	**-**	**480**	**520**	**1000**	**24**

Total Credits= 22

Semester 4th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	L	T	P	Int.	Ext.	Total	
BRMIS1-401	Radiology equipment – Theory	3	1	0	40	60	100	4
BRMIS1-402	Non-Contrast Radiography (Soft Tissue) - Theory	3	1	0	40	60	100	4
BRMIS1-403	Radiation Safety and Hazards	3	1	0	40	60	100	4
BRMIS1-404	Community Health	1	1	0	40	60	100	2
BRMIS1-405	Nutrition	1	1	0	40	60	100	2
BRMIS1-406	Radiology equipment – Practical	0	0	4	60	40	100	2
BRMIS1-407	Non-Contrast Radiography(Soft Tissue)- Practical	0	0	4	60	40	100	2
BRMIS1-408	Radiation Safety and Hazards--Practical	0	0	4	60	40	100	2
Total		-	-	-	**380**	**420**	**800**	**22**

Total Credits= 25

Semester 5th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	L	T	P	Int.	Ext.	Total	
BRMIS1-501	Basic and Advanced Ultra Sound Imaging – Theory	3	1	0	40	60	100	4
BRMIS1-502	Nuclear Medicine Imaging	3	1	0	40	60	100	4
BRMIS1-503	Basic and Advanced CT Scan – Theory	3	1	0	40	60	100	4
BRMIS1-504	Hospital Products, Promotion, Sales & Public relations and Physician's Office Management	3	1	0	40	60	100	4
BRMIS1-505	Occupational Safety & Health	1	1	0	40	60	100	2
BRMIS1-506	Healthcare	1	1	0	40	60	100	2
BRMIS1-507	Basic and Advanced Ultra Sound Imaging – Practical.	0	0	4	60	40	100	2
BRMIS1-508	Nuclear Medicine Imaging - Practical	0	0	2	60	40	100	1
BRMIS1-509	Basic and Advanced CT Scan – Practical -Practical.	0	0	4	60	40	100	2
Total		**-**	**-**	**-**	**420**	**480**	**900**	**25**

Semester 6th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	L	T	P	Int	Ext.	Total	
BRMIS1-601	Quality Assurance & Radiation Safety (AERB Guidelines) in Diagnostic Radiology	3	1	0	40	60	100	4
BRMIS1-602	Research methodology	3	1	0	40	60	100	4
BRMIS1-603	Hospital Practice & Care of Patients	3	1	0	40	60	100	4
BRMIS1-604	Professionalism, Values and Management	3	1	0	40	60	100	4
BRMIS1-605	Medical Law & Ethics	3	1	0	40	60	100	4
BRMIS1-606	Quality Assurance & Radiation Safety -Practical	0	0	2	60	40	100	1
BRMIS1-607	Hospital Practice & Care of Patients - Practical	0	0	2	60	40	100	1
Total		**-**	**-**	**-**	**320**	**380**	**700**	**22**

1 Year Internship (Optional)

3years + 1 years internship program (For Nepal, and SAARC) countries only

This internship can be of 6+ 6 months or 4+4+4 months in different hospitals. The college will authenticate the certificates from hospitals after successful training. The university can enter Internship as satisfactory/unsatisfactory for 4th year in the degree, as is done by some universities for courses where there is Project Work for whole of the year.

Overall Marks / Credits

Semester	Marks	Credits
1st	700	21
2nd	800	23
3rd	1000	24
4th	800	22
5th	900	25
6th	700	22
Total	4900	137

ANATOMY, PHYSIOLOGY, PATHOLOGY AND PHARMACOLOGY RELATED TO RADIOLOGY – THEORY

Subject Code: **BRMIS1-301** **L T P C** **Duration: 60 (Hrs.)**
3 1 0 4

Course Objectives:

- Anatomy provides information about structure, location, and organization of different parts of the body that is needed to truly understand physiology. Together, anatomy and physiology explain the structure and function of the different components of the human body to describe what it is and how it works

Course Outcomes:

- This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms

Unit-1 **(15 Hrs)**

- **Pathology:** Definition, important terminology, different branches
- **Cell Injury and Cellular Adaptations:** Normal Cell, *Cell Injury:* types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling. *Cell Death:* types- Autolysis, Necrosis, Apoptosis &Gangrene. *Cellular Adaptations*: Atrophy, Hypertrophy, Hyperplasia & Dysplasia.

Unit-2 **(15 Hrs)**

- **Inflammation:** Acute inflammation - vascular event, cellular event, inflammatory cells. Chronic Inflammation - general features, granulomatous inflammation, tuberculoma.
- **Hemodynamic Disorders:** Edema, hyperemia, congestion, hemorrhage, circulatory disturbances, thrombosis, ischemia & infarction.

Unit-3 **(10 Hrs)**

- **Healing:** Definition, different phases of healing, factors influencing wound healing.
- **Neoplasia:** Definition, , difference between benign tumor and malignant tumor

Unit-4 **(20 Hrs)**

- Surface anatomy, Plain film / conventional radiographs, Mammograph, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Ultrasound, Nuclear medicine, Digitally Reconstructed Radiographs (DRR) , Portal imaging

- **Recommended Text Books / Reference Books:**

1. Anatomy and Physiology for Radiographers- C.A. Werrick
2. Imaging Atlas of Human Anatomy – Jamie Weir et all (Mosby-Elsevier)
3. An Atlas of Normal Radiographic Anatomy – Richard and Alwin.
4. Anatomy and Physiology for Nurses
5. Comprehensive Radiographic Pathology. Ronald L. Eisenberg, NancyM. Johnson
6. Surface and Radiological Anatomy – Hamilton et al (Heffer)
7. An Atlas of normal radiographic Anatomy – Ross and Wilson.
8. Dean : Basic Anatomy and Physiology for Radiographers (Blackwell)
9. Fitzgerald : Anatomy 1600 multiple choice question (Butterworth)
10. Hamilton et al : Surface and Radiological Anatomy (Heffer)
11. X-Ray Equipment Maintenance and Repairs Workbook for Radiographers and Radiological Technologists Produced by the WHO Dept. of Essential Health Technology Series. Ian R. McClelland, Publisher- WHO, 2004.
12. Quality Assurance Workbook for Radiographers & Radiologic Technologists, Peter J. Lloyd, Nonserial Publication, WHO

RADIOLOGICAL PHYSICS AND DARK ROOM TECHNIQUES THEORY

Subject Code: **BRMIS1 -302** **L T P C** **Duration: 60 (Hrs.)**
3 1 0 4

Course Objectives:

- To understand the mechanisms describing radioactive decay and the production of ionizing radiation; the interactions of ionizing radiation with matter; describe the imaging and treatment equipment used for the clinical care of cancer patients; discuss the use of devices and protocols for the accurate measurement of ionizing radiation and calibration of clinical equipment; understand the role of the physicist in radiation medicine

Course Outcomes:

- Basic principles of radiation physics: radioactivity, the physics of ionizing radiation, radiation dosimetry, imaging equipment, radiation therapy equipment and radiation detectors

Unit-1 **(15 Hrs)**

- **Dark Room: The processing area:** Dark room design: construction & illumination. Entrance safe lighting: types. Storage, Shelving of films, Cleaning and maintenance
- **X-Ray film:** Composition of single and double coated radiographic films, Structure of emulsion, film characteristics (speed, base + fog, gamma, latitude). Latent image formation, Image intensifiers and cassettes (structure and function), types of image intensifiers and relative advantage, loading and unloading of cassettes and their care/maintenance, Effects of kV and mA on variation of emitted radiation intensity, Determination of relative speeds, Film contrast, Film screen contact, Film storage, handling.

.

Unit-2 **(15 Hrs)**

- **Film Processing:** Principles: Acidity, Alkalinity, pH, The processing cycle, development, developer solution, Fixing, fixer solution, washing, drying replenishment, checking and adjusting. Replenishment rates, manual and automatic processing, Silver recovery, Auto and manual chemicals

Unit-3 **(10 Hrs)**

- **Equipment for Film Processing:** Functions of various components, Film roller transport - transport time, film feed system, Importance and relation to temp, fixed and variable time cycles. Care and maintenance (cleaning routine and methods of cleaning).

Unit-4 **(20 Hrs)**

- **Factors affecting Image Quality:** Meaning of radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur. Radiographic illuminators and viewing conditions, visual acuity and resolution. Quality assurance of the related equipment and its benefits w.r.t visual assessment.

Recommended Text Books / Reference Books:

1. Physics for Radiography - Hay and Hughs
2. Ball and mores essential physics radiographers, IV edition, Blackwell publishing.
3. Basic Medical Radiation physics – Stanton. 4. Christensen's Physics of Diagnostic Radiology – Christensen.
4. X-Ray Equipment Maintenance and Repairs Workbook for Radiographers and Radiological Technologists Produced by the WHO Dept. of Essential Health Technology Series. Ian R. McClelland, Publisher- WHO, 2004.
5. Quality Assurance Workbook for Radiographers & Radiologic Technologists, Peter J. Lloyd, Nonserial Publication, WHO

GENERAL RADIOLOGY POSITIONING THEORY

Subject Code: **BRMIS1-303** **L T P C** **Duration: 60 (Hrs.)**
3 1 0 4

Course Objectives:

- It is used to diagnose or treat patients by recording images of the internal structure of the body to assess the presence or absence of disease, foreign objects, and structural damage or anomaly. During a radiographic procedure, an x-ray beam is passed through the body

Course Outcomes: Students will demonstrate competency in image evaluation.

- Students will apply knowledge and skills to practical situations.
- Students will adapt to patient's condition when performing non-routine procedures.
- Students will position patients with accuracy.
- Students will select appropriate technical factors.
- Students will apply principles of radiation protection.

Unit-1 **(15 Hrs)**

- Upper extremity - basic views
- Lower extremity (including pelvis) - basic views
- Spine - Cervical, dorsal, lumbar, lumbo-sacral (including functional views).

Unit-2 **(15 Hrs)**

- Skull – including trauma cases
- Facial bones (nasal bones, zygomatic, orbits, maxilla)
- Mandible, Temporo- Mandibular Joints, Mastoids, petrous temporal bones

Unit-3 **(15 Hrs)**

- Chest including thoracic age and sternum
- Abdomen - erect, supine, lateral decubitus
- Soft tissue radiography : Larynx, pharynx, nasopharynx, thoracic inlet

Unit-4 **(15 Hrs)**

- Dental radiography
- General Pediatric Radiography
- High kV technique
- Macro radiography

Recommended Books:

1. Diagnostic Radiography" Glenda. J. Bryan (ELBS)
2. "Positioning in Radiography" Clarks (CBS Publishers, New Delhi.) Reference books "Radiographic positions and Radiological procedures" Vinita Merrill (Jaypee Brothers, New Delhi)
3. "Manual of Radiographic Technique" T. Holn& P.E.S. Palmer (World Health Organisation)
4. " Text book of Radiologic -Technology" Jacoby and Paris (Mosby
5. "Contrast Radiography" Scarrow (Schering Chemical)
6. " A manual of Radiographic positioning" Greenfield and Cooper (Lipincott)
7. "Illustrated guide to X-ray Techniques" Culliman (Blackwell)
8. A Guide to Radiological Procedures" Stephen Chapman & Richard Nakielny. (A Prism books (P) Ltd., Bangalore) 8. Applied angiography for Radiographers Paul & Douglas (W.B. Saunder company

FUNDAMENTALS OF RADIO IMAGING TECHNOLOGY

Subject Code: **BRMIS1-304** **L T P C** **Duration: 60 (Hrs.)**

3 1 0 4

Course Objectives:

- Imaging is a range of tests used to create images of parts of the body. These can help: screen for possible health conditions before symptoms appear. diagnose the likely cause of existing symptoms.

Course Outcomes:

- Demonstrate knowledge of radiology and imaging techniques for efficient diagnosis of the diseased or un-diseased state.
- Identify and solve complex problems arising during the procedure of radio diagnostic procedure of the patients.
- Utilize modern tools and modalities in the arena of medical imaging technology for better outcomes

Unit-1 **(10 Hrs)**

- Properties of Light,
- Uses of Light in Medicine, Lasers and Holography,
- Doppler's effect, Use of principle of Doppler's effect in Diagnostic radiology (e.g. Echo, blood flow measurement).
- Ultrasonic wave, production of ultrasonic wave (piezo-electric effect) in ultrasonography.

Unit-2 **(25 Hrs)**

- Introduction to X-Rays, Properties of X- Rays, X-Ray production, Bremstrauhlung phenomenon, factors affecting X-Ray emission spectra, X-Ray quality and quantity, HVL measurements, filtration, reflection and transmission targets, requirements for X-Ray production (electron source, target and anode material), tube voltage, current, space charge, early X-Ray tubes (coolidge tubes, tube envelop and housing) cathode assembly, X-Ray production efficiency
- **Interaction with matter** grids &bucky tables etc (except biological interactions)
- **X-Ray Tubes**- Historical aspects ,Construction of various types of X-Ray Tubes & their functioning (The stationary anode X-Ray tube, rotating anode X-Ray tube , Heavy duty X-Ray tube, The grid controlled X-Ray tube, Mammography X-Ray tube, Micro focus X-Ray tube, Super rotalix ceramic X-Ray tube etc) The insert/filament/anode rotation/anode/anode speed, X-Ray tube inherent and added filtration

Unit-3 **(10 Hrs)**

- Physical quantity, its unit and measurement- Fundamental and derived quantity, SI unit, various physical/radiation quantity used in diagnostic radiology and its unit (for example, KvP, mA, mAS, Heat unit (HU), Radiation exposure, Absorbed dose, Equivalent dose, etc.).

Unit-4 **(15 Hrs)**

- **Radioactivity :** Structure and property of nucleus, Nuclear forces, Binding energy, Radioactive decay, law of radioactive decay (decay equation, half-life, mean life), excitation & ionization, characteristic X-Ray, charts of radionuclides: alpha, beta, positron, gamma emissions, Modes of decay, isomeric transitions, internal conversion, Naturally occurring radio-nuclides.

- **Recommended Text Books / Reference Books:**

1. "Christensen's Physics of diagnostic Radiology" (Lea & Febiger) Reference books
2. " First year Physics for Radiographers Hay & Hughes (ELBS)
3. "Basic Medical Radiation Physics Stantor (Appleton- Century & Crofts)

4. X- ray Equipment for student Radiographers" By: Chesney & Chesney (Blackwell)
5. A Manual of Radiographic equipment. By: Sybil M. Stockley (Churchill Livingstone)
6. "Principles of Diagnostic X-ray apparatus" by : Hill (Macmillan.)
7. "Radiologic science for Technologist" Stewart C. Bushong , (M Mosby.)

BIOSTATISTICS AND COMPUTER APPLICATION

Subject Code: **BRMIS1 -305** **L T P C** **Duration: 30 (Hrs.)**
1 1 0 2

Course Objectives:

- Defining the type and quantity of data need to be collected. Organizing and summarizing the data. Analyzing the data and drawing conclusions from it. Assessing the strengths of the conclusions and evaluating their uncertainty

Course Outcomes:

- In this course we'll learn how to effectively collect data, describe data, and use data to make inferences and conclusions about real world .

Unit -1. **(10 Hrs)**

- Definition & Calculations of mean(by both direct and shortcut method and step deviation method) mode and Median(individual observation, discrete observation and continuous observation .
- Probability

Unit-2. **(10 Hrs)**

- Tabulation of Data Graphical Presentation of Frequency Distribution :Line frequency, Histogram(for equal and unequal class interval, inclusive data and for Midvale)
- Frequency polygon
- Frequency curve
- Cumulative frequency curve

Unit-3. **(10 Hrs)**

- **Computer :** Input/ output, memory, data representation and number system, software, Abbreviation related to computer

Reference Book

- Mausner & bahn : Epidemiology-An Introductory text, 2nd Ed., W.B. Saunders Co.
- Richard f. Morton & j. Richard hebd : A study guide to Epidemiology and Biostatistics, 2 nd Ed., University Park Press, Baltimore.
- Sylvia W Smoller, J Smoller, Biostatistics & Epidemiology A Primer for health and Biomedical professionals, 4th edition, Springs, 2015

BASIC PRINCIPLES OF HOSPITAL MANAGEMENT

Subject Code: **BRMIS1 -306** **L T P C** **Duration: 30 (Hrs.)**
1 1 0 2

Course Objectives:

- The project "Hospital management system" is aimed to develop to maintain the day –to-day state of admission/discharge of patients, list of doctors, reports generation, and etc

Course Outcomes:

- Hospital Management course trains the students for managerial and administrative roles at a hospital or a healthcare institute

Unit-1 **(10 Hrs)**

- Quality assurance and management: Concepts of Quality of Care, Quality Improvement Approaches, . Standards and Norms, Quality Improvement Tools, Introduction to NABH guidelines.

Unit-2 **(10 Hrs)**

- Basics of emergency care and life support skills - Basic life support (BLS), cardiopulmonary resuscitation (CPR), Vital signs and primary assessment, Basic emergency care – first aid and triage, Ventilations including use of bag-valve-masks (BVMs) , Choking, rescue breathing methods , One- and Two-rescuer CPR. Using an AED (Automated external defibrillator). Managing an emergency including moving a patient

Unit-3 **(10 Hrs)**

- Definition of Biomedical Waste, Waste minimization, BMW – Segregation, collection, transportation, treatment and disposal (including color coding), Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste , BMW Management & methods of disinfection , Modern technology for handling BMW g. Use of Personal protective equipment (PPE), Monitoring & controlling of cross infection (Protective devices)

Recommended Text Books / Reference Books:

1. National Health Programs Of India National Policies and Legislations Related to Health: 1 J. Kishore (Author)
2. A Dictionary of Public Health Paperback by J Kishor
3. Health System in India: Crisis & Alternatives , National Coordination Committee, Jan SwasthyaAbhiyan
4. In search In Search of the Perfect Health System
5. Central Bureau of Health Intelligence (1998). Health Information of India, Ministry of Health and Family Welfare, New Delhi.
6. Goyal R. C. (1993). Handbook of Hospital Personal Management, Prentice Hall of India, New Delhi, 17–41. Ministry of Health and Family Welfare (1984). National Health Policy, Annual Report (1983–4), Government of India, New Delhi
7. Historical Development of Health Care in India, Dr. Syed Amin Tabish,
8. cultural Competence in Health Care by Wen-Shing Tseng (Author), Jon Streltzer (Author)

ANATOMY, PHYSIOLOGY, PATHOLOGY AND PHARMACOLOGY RELATED TO RADIOLOGY-PRACTICAL

Subject Code: BRMIS1-307 **L T P C** **Duration: 30(Hrs.)**

0 0 2 1

Objective: Anatomy provides information about structure, location, and organization of different parts of the body that is needed to truly understand physiology. Together, anatomy and physiology explain the structure and function of the different components of the human body to describe what it is and how it works

Experiments:

- Study of human skeleton.
- Study with the help of charts and models of the following systems and organs. a) Digestive system e) Reproductive system b) Respiratory system f) Nervous system c) Cardio-vascular system g) Eye d) Urinary system h) Ear
- Microscopic examination of epithelial tissue, cardiac muscle, smooth muscle, skeletal muscle, connective tissue and nervous tissue.
- Examination of blood films for TLC, DLC and malarial parasite.
- Determination of clotting time of blood, erythrocyte sedimentation rate and hemoglobin value.
- Recording of body temperature, pulse, heart rate, blood pressure and ECG.
- Demonstration of basic procedures with all radiographic equipments
- Computer tomography
- Mammograph
- Magnetic resonance imaging (MRI)
- Ultrasound
- Digitally reconstructed radiographs (DRR)
- Portal imaging

RADIOLOGICAL PHYSICS AND DARK ROOM TECHNIQUES PRACTICAL COMPREHENSIVE VIVA

Subject Code: BRMIS1-308 | **L T P C** | **Duration: 30(Hrs.)**
0 0 2 1

Objective: To understand the mechanisms describing radioactive decay and the production of ionizing radiation; the interactions of ionizing radiation with matter; describe the imaging and treatment equipment used for the clinical care of cancer patients; discuss the use of devices and protocols for the accurate measurement of ionizing radiation and calibration of clinical equipment; understand the role of the physicist in radiation medicine

Experiments:

- Study of dark room: Day light processing-location of the dark room
- dark room illumination equipment and layout-x-ray viewing room.
- Daylight handling-daylight systems with cassettes-without cassettes.
- X-ray film materials: Structure of film emulsion-Grain technology-Geletine-Basic film types-Film formats and packing-Direct exposure duplitised films-Single coated emultions Films for specialised use-manufacturing process.
- Sensitometry :Photographic density—characteristic curve –information from the characteristic curve-speed Vs definition
- Storage of x-ray film-unprocessed film-radiographs
- x-ray cassette-design-types- Identification of cassettes- General care of cassettes and storage.
- .To study different equipment of film processing
- to study different factors effecting film quality

GENERAL RADIOLOGY POSITIONING-PRACTICAL

Subject Code: BRMIS1-309 | **L T P C** | **Duration: 30(Hrs.)**
0 0 2 1

Objective: It is used to diagnose or treat patients by recording images of the internal structure of the body to assess the presence or absence of disease, foreign objects, and structural damage or anomaly. During a radiographic procedure, an x-ray beam is passed through the body

Experiments

- Spine- vertebra and disc, spinal cord and meninges
- X ray study of bones of skull (troma cases), facial bones
- Dental radiography
- General pediatric radiography
- High kv technique
- Table top exposure rate measurement in fluoroscopy.
- demonstration of basic procedures with all radiographic equipments. Examples-demonstration of ctscan, mri, c.r.D.r.
- demonstration of basic radiotherapy units.

FUNDAMENTALS OF RADIO IMAGING TECHNOLOGY - PRACTICAL

Subject Code: BRMIS1-310 **L T P C** **Duration: 30(Hrs.)**
0 0 2 1

Objective: Imaging is a range of tests used to create images of parts of the body. These can help: screen for possible health conditions before symptoms appear. diagnose the likely cause of existing symptoms.

Experiments:

- Quality assurance and Radiation safety survey in diagnostic X-ray installations.
- Community orientation and clinical visit: Visit will include visit to the entire chain of healthcare delivery system - sub centre, PHC, CHC, SDH, DH and Medical College, private hospitals, dispensaries and clinics. .
- Perform and execute the patient care techniques.
- plan and perform the radiation protection using the monitoring devices
- Clinical visit to their respective professional department within the hospital
- Table top exposure rate measurement in fluoroscopy.
- .Demonstration of basic procedures with all radiographic equipments. Examples- demonstration of CT scan , MRI, C.R. D.R.
- Demonstration of basic Radiotherapy units
- Port film, processing and development
- techniques of Radiotherapy such as SRS, SRT, IMRT, IGRT and Tomotherapy
- INTERVENTIONAL RADIOLOGY : Indication , Clinical Application , Name of different type of procedure

4TH SEMESTER

RADIOLOGY EQUIPMENT- THEORY

Subject Code: **BRMIS1 -401** **L T P C** **Duration: 60 (Hrs.)**
3 1 0 4

Course Objectives:

- This course has been designed to provide the knowledge and foundation to efficiently process radiographic images from a variety of different types of radiographic recording media including: x-ray film, computed radiography (CR), and direct-capture radiography (DR)

Course Outcomes:

- This course prepares students to practice as a radiographer. Students have the opportunity to simulate in a laboratory setting the skills needed to efficiently process diagnostic radiographic images utilizing x-ray film and computed radiography (CR)

Unit-1 **(15 Hrs)**

- **X-ray machines – X-Ray tube:** historical aspects - early X-Ray tubes (coolidge tubes) - construction of X-Ray tubes, requirements for X-Ray production (electron source, target and anode material), anode angulation and rotating tubes- tube voltage, current - space charge - tube envelop and housing - cathode assembly, XRay production efficiency, advances in X-Ray tubes, Common factors affecting thermionic emission -specialized types- grid controlled and high speed tubes. Inherent filtration, radiation leakage and scattered radiation. Heat dissipation methods- Interlocking and X-Ray tube overload protection -tube rating, heat units - operating conditions, maintenance and Q.A procedures.
- **Portable/Mobile X-ray units-** Equipment for mobile radiography-principleuses- mobile image intensifiers– Capacitor discharge unit- advantages and limitations -positioning differences-skill in using mobile units - - radiation protection.- mobile units types-differences-Cordless mobiles-selection of equipment..

Unit-2 **(15 Hrs)**

- **Fluoroscopy:** Fluoroscopic equipment-Direct fluoroscopy – The serial changer (spot film device) - Fluoroscopic screen -fluoroscopic image -factors affecting the Fluoroscopic image. Image intensifier tubes – principle construction and function regarding intensified image- cine flurography-mode of operation - Types of day light film handling system-optical coupling and methods of viewing- Automatic brightness control- tilting tables - over and under couch tubes-safety features. The television process – television camera tube– the Cathode ray tube – ielevision image-CCTV. Quality assurance tests for fluoroscopic equipment.
- **Computed Radiography (C.R)** –equipment parts –advances- principle of imaging – applications- advantages & disadvantages.
- **Digital Radiography**– principle - photostimulable phosphors-image acquisition-digital spot imaging - equipment parts –advances-imaging– advantages & disadvantages. Picture characteristics - archiving possibilitiestransfer system and designs- Image recording devices-laser imager and multiformatter-Future developments.

Unit-3 **(10 Hrs)**

- **Mammography** -basic principle, equipment & image acquisition-conventional & digital mammo studies- Mammotomogram.

- **Dental Radiography** – Equipment Basics –types of equipments- Intra oral radiography unit-orthopantomograph unit -imaging techniques- Dental films-film types and processing.
- **Angiography Equipments-** Basic physics and principle of image acquisition convention alangio- DSA-Cardiac Cath lab. Equipments- advantages-limitations – Dosimetry – Maintenance

Unit-4 **(20 Hrs)**

- **Tomography:** Theory of tomography – multi section radiography- Tomography equipment- Basic requirements and controls, attachments. Computed tomography – Scanning principle – Reconstruction of image – storing the image – viewing the image – evaluation of the image. Types of movements and applications-Effect on image of variation in focus object distance-Object film distance, exposure angle, and tube movement pattern.
- **Computed Tomography**- Basic physics – Tomography principle - detectors technology-digital fundamentals- Basic data acquisition concepts -Scanning principle - basics of plain studies- Image reconstruction- artifacts- contrast studies,-special procedures – image quality-storing the image – viewing the image – evaluation of the image- Equipment for computed tomography – Table, scanning gantry X-Ray generator – CT control console. Scanner types - technologic considerations of sequential /spiral volume zoom -computer hard wire of software– CT computer and image processing system- Options and accessories for CT systems.-Tools for use in CT guided Interventional procedures- Dosimetry- Future developments.

- **Recommended Books:**

1. "Diagnostic Radiography" Glenda.J. Bryan (ELBS)
2. "Positioning in Radiography" Clarks (CBS Publishers, New Dilhi.)
3. "Radiographic positions and Radiological procedures" Vinita Merrill (Jaypee Brothers, New Delhi) 2."Manual of Radiographic Technique" T. Holn& P.E.S. Palmer (World Health - 12 - 12 Organisation)
4. " Text book of Radiologic -Technology" Jacoby and Paris (Mosby)
5. "Contrast Radiography" Scarrow (Schering Chemical)
6. " A manual of Radiographic positioning" Greenfield and Cooper (Lipincott)
7. "Illustrated guide to X-ray Techniques" Culliman (Blackwell)
8. " A Guide to Radiological Procedures" Stephen Chapman & Richard Nakielny. (A Prism books (P) Ltd., Bangalore)
9. Applied angiography for Radiographers " Paul & Douglas (W.B. Saunder Company)

NON-CONTRAST RADIOGRAPHY (SOFT TISSUE)-THEORY

Subject Code: **BRMIS1 -402** **L T P C** **Duration: 60 (Hrs.)**
3 1 0 4

Course Objectives:

- To Introduce concept of Non contrast radiology

Course Outcomes:

- Students will have knowledge of concept of sodt tissue radiology and their procedure

* For all units: Radiographic and technical considerations, equipment requirement, conditions essential for optimal image quality

Unit-1 **(15 Hrs)**

- Clinical indications and contraindications - patient preparation
- Radiographic projections - abdomen – soft tissue radiography

Unit-2 **(15 Hrs)**

- Dental Radiography
- Radiation (projection and timing)

Unit-3 **(15 Hrs)**

- Normal anatomy on films, foreign body localization , additional techniques,
- Identification & differentiation of various Images

Unit-4 **(15 Hrs)**

- Radiation protection, patient management, care of patients during and after examination.
- Radiographer's role in the team.

Recommended Books:

1. Textbook of Dental radiology by Pramod John R
2. Textbook of Radiology handbook by J.S. Benseller, D.O.
3. Quantitative ultrasounds in soft tissues by Jonathan Mamou and Michael L. Oelze
4. A Textbook of Radiology and imaging by David Sutton

RADIATION SAFETY AND HAZARDS

Subject Code: **BRMIS1 -403** **L T P C** **Duration: 60 (Hrs.)**
3 1 0 4

Course Objectives:

- A primary goal of the radiation protection program is to reduce radiation doses wherever and whenever reasonably achievable, thereby reducing the health risk that is assumed to be proportional to the radiation dose

Course Outcomes:

- Identify the parts of the x-ray machine and explain their purpose and function. Explain how x-rays are produced and how they travel without harm to patient .Demonstrate use of the controls on a x-ray machine and explain how they influence the x-ray beam. Compare the effects that x-radiation has on a variety of biological and non-biological materials.

Unit-1 **(15 Hrs)**

- **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,

Unit-2 **(15 Hrs)**

- **Radiation protection:** 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-3 **(15 Hrs)**

- **Biological effects of Ionizing Radiation:** 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.
- Dose fractionation. Effects of ionizing radiation on each of major organ system including fetus stochastic and non-stochastic effects.

Unit-4 **(15 Hrs)**

- **Biological effects of Ionizing Radiation:** Mean and lethal dose, direct and indirect effects, multi target and multi hit theory.
- Radio sensitivity factors affecting radio sensitivity, RBE, Survival curves.
- **Biological effects of non-ionizing radiation**: Ultrasound, Sound lasers, IR, UV , Magnetic fields

Recommended Text Books / Reference Books:

1. Text book 1." Care of patient in diagnostic Radiography" Chesney & Chesney (Blackwell Scientific) Reference books
2. " Chesney's Care of the patient in Diagnostic Radiography" Pauline J . Culmer. (Blackwell Scientific)
3. " Aid to Tray and Trolley Setting" Marjorie Hougton (Bacilliere)
4. "First Aid' Haugher& Gardner (Hamlyn.)
5. "Practical nursing and first- aid" Ross and Wilson (Livingstone)

COMMUNITY HEALTH

Subject Code: BRMIS1 -404 **L T P C** **Duration: 30 (Hrs.)**
1 1 0 2

Course Objectives:

- The aim of community health practice is to promote health and efficiency, prevent and control diseases and disabilities and prolong life by providing need based, well balanced comprehensive health care services to community at large through organized community efforts.

Course Outcomes:

- Community health is a medical specialty that focuses on the physical and mental well-being of the people in a specific geographic region

Unit-1 **(10 Hrs)**

- General concepts of health and diseases with reference to natural history of disease with pre-pathogenic and pathogenic phase.
- The role of socio-economic and cultural environment in health and diseases-Epidemiology and scope.
- Public health administration-An overall view of the health Administration set up at .
- centre and state levelThe National Health Programmes- National Health programmes including tuberculosis, malaria, MCH and HIV/AIDS.

Unit-2 **(10 Hrs)**

- Health problems in vulnerable groups-Pregnant and lactating women and infants and school going children-occupational groups, geriatrics.
- Occupational Health- Definition, scope-Occupational diseases, prevention of occupational diseases and hazards.
- Social security and other measures for the protection of occupational hazards, accidents and disease. Details of compensation acts.

Unit-3 **(10 Hrs)**

- Family planning objectives of National family planning methods. A general idea of advantages and disadvantages of the method.
- Mental Health- community aspects of mental health; role of physiotherapists, therapists in mental health problems such as mental retardation etc.
- Communicable disease-An overall view of the communicable disease. Classification according to the principal mode of transmission. Role of insects and their vectors.
- International health agencies

Recommended Text Books / Reference Books:

1. Textbook of Preventive and Social medicine by k. Park, 21st edition, published by BanarsidasBhanot

NUTRITION

Subject Code: BRMIS1 -405 **L T P C** **Duration: 30 (Hrs.)**
1 1 0 2

Course Objectives:

- Helping people lose weight, maintain a healthy weight, and prevent chronic disease by improving dietary habits requires providing education about food and nutrition, assuring access to healthier food options, and promoting the desire and ability to become physically active.

Course Outcomes:

- Nutrition also focuses on how people can use dietary choices to reduce the risk of disease, what happens if a person has too much or too little of a nutrient, and how allergies work. Nutrients provide nourishment. Proteins, carbohydrates, fat, vitamins, minerals, fiber, and water are all nutrients.

Unit-1 **(5 Hrs)**

- Introduction to science of nutrition
- Food pattern and its relation to health
- Factors influencing food habits, selection and food stuffs

Unit-2 **(12 Hrs)**

- Food selection, storage & preservation
- Classification of nutrients – macronutrients and micronutrients
- Proteins – types, sources requirements and deficiencies of proteins
- Carbohydrates sources, requirements & efficiency

Unit-3 **(13 Hrs)**

- Fats – types, sources, requirements, deficiency and excess of fats
- Water – sources of drinking water, requirements, preservation of water
- Minerals – types, sources, requirements deficiencies of minerals
- Vitamins – types, sources, requirements deficiencies of vitamins
- Planning diets including renal diets

Recommended Text Books / Reference Books:

1. Biochemistry Ed. LubertStryer. W.H. Freeman and Company, New York.
2. Principles of Biochemistry. Ed. Lehinger, Nelson and Cox. CBS Publishers and distributors.
3. Harper"s Biochemistry, Ed. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell. Appleton and Lange, Stamford, Connecticut.
4. Textbook of Biochemistry with Clinical Correlations. Ed. Thomas M. Devlin, Wiley-Liss Publishers.
5. Tietz Textbook of Clinical Chemistry. Ed. Burtis and Ashwood. W.B. Saunders Company.
6. Biochemistry. Ed. Donald Voet and Judith G. Voet. John Wiley & Sons, Inc.

RADIOLOGY EQUIPMENT – PRACTICAL

Subject Code: BRMIS1-406 **L T P C** **Duration: 30(Hrs.)**
0 0 4 2 .

Objective: This course has been designed to provide the knowledge and foundation to efficiently process radiographic images from a variety of different types of radiographic recording media including: x-ray film, computed radiography (CR), and direct-capture radiography (DR)

Experiment

- Study with charts, models & power point presentations Atomic structure, X-ray tubes, X-ray circuits involving students to present and discuss.
- Congruence of Radiation and Optical field and beam.
- Determination of focal spot size of diagnostic X-ray tube.
- K.V. and Exposure time testing.
- Linearity testing of the Timer.
- Consistency of M.A. loading.
- Consistency of Radiation Output.
- Evaluation of Total filtration of the tube.

NON-CONTRAST RADIOGRAPHY SOFT TISSUE – PRACTICAL

Subject Code: BRMIS1-407 **L T P C** **Duration: 30(Hrs.)**
0 0 4 2

Objective: Course Objectives: To Introduce concept of Non contrast radiology

Experiments

- Non-contrast CT chest
- Dental Radiographs
- Mammography
- Radiography of soft tissue of the foot and ankle with diffraction enhanced imaging

RADIATION SAFETY AND HAZARDS -PRACTICAL

Subject Code: BRMIS1-408 **L T P C** **Duration: 30(Hrs.)**
0 0 4 2

Objective: A primary goal of the radiation protection program is to reduce radiation doses wherever and whenever reasonably achievable, thereby reducing the health risk that is assumed to be proportional to the radiation dose

Experiment

- Film screen contact testing.
- Table top Exposure rate measurement in fluoroscopy.
- C.R (principle, equipment & imaging)
- Digital Radiography (principle, equipment & imaging)
- Mammography (basic principle, equipment & image acquisition)
- CT (Basic physics –Tomography principle - basics of plain studies, contrast studies, Special procedures)
- MRI (basic principle – imaging methods - slice section- plain & contrast studies – image contrast – factors affecting image quality)
- USG (Basic acoustics - ultrasound terminologies – Interaction of US with matter – Ultrasound display modes etc)