Department of Paramedical Sciences

Faculty of Allied Health Sciences

SGT UNIVERSITY

Shree Guru Gobind Singh Tricentenary University

Gurgaon-122505

Syllabus

B.Sc. Radio-Imaging Technology (RIT)

Duration: 3 years (6 Semester)

W.e.f. Academic Session 2020-21

B.Sc Radio-Imaging Technology Scheme of Examination

Particular			Credits	Marks
B.Sc. R.I.T 1st Year				
1st Semester				
1	Human Anatomy- I (Theory)	C-BRIT-01	4	100
	Practical		2	50
2	Human Physiology-I	C-BRIT-02	4	100
3	General Microbiology & Pathology	C-BRIT-03	4	100
4	Radiation Physics & Fundamental of Medical Imaging (Theory)	C-BRIT-04	4	100
	Practical		2	50
5	Communication Skills & Personality Development	AEEC-BRIT-01	2	100
Total			**22**	**600**
2nd Semester				
1	Human Anatomy- II	C-BRIT-05	4	100
	Practical		2	50
2	Human Physiology- II	C-BRIT-06	4	100
3	Image Acquisition, Processing & Archiving (Theory)	C-BRIT-07	4	100
	Practical		2	50
4	General Radiography Positioning & terminology- I (Theory)	C-BRIT-08	4	100
	Practical		2	50
5	Fundamentals of Computer Science	ASEC-BRIT-01	2	100
Total			**24**	**650**
B.Sc. R.I.T 2nd Year				
3rd Semester				
1	General Radiography Positioning & terminology- II (Thoery)	C-BRIT-09	4	100
	Practical		2	50
2	Ultrasound & Doppler including 4D & Echocardiography (Theory)	C-BRIT-10	4	100
	Practical		2	50
3	Radiation biology and its Hazards & Protection(Theory)	C-BRIT-11	4	100
	Practical		2	50
4	Medical Emergencies & Patient Care	C-BRIT-12	4	100
5	Environmental Sciences	AEEC-BRIT-02	4	100
Total			**26**	**650**
BRIT 4th Semester				
1	Advance Physics & Instrumentation in Digital Imaging &	C-BRIT-13	4	100
2	Computed Tomography -Basic principle and techniques (Theory)	C-BRIT-14	4	100
	Practical		2	50
3	Special Investigations& Pathology (Theory)	C-BRIT-15	4	100

	Practical		2	50
4	Nuclear Medicine & PET Scan (Theory)	C-BRIT-16	4	100
	Practical		2	50
5	Magnetic Resonance Imaging-Basic principle and techniques (Theory)	C-BRIT-17	4	100
	Practical		2	50
Total			**28**	**700**
B.Sc R.I.T 3rd Year				
5th Semester				
1	MRI Clinical Applications & Imaging protcols (Theory)	C-BRIT-18	4	100
	Practical		2	100
2	Intervention in Diagnostic Radiology (Theory)	C-BRIT-19	4	100
	Practical		2	100
3	CT Clinical Applications & Imaging Protocols (Theory)	C-BRIT-20	4	100
	Practical		2	100
4	Hospital Management & Medical Ethics	C-BRIT-21	4	100
5	Research Methodology & Biostatistics	ASEC-BRIT-02	2	50
Total			**24**	**750**
6th Semester				
1	Evaluation of Clinical Practice & Internship (Submission of Report)	EGI/OE-BRIT-01	16	400
2	Technical Writing	EGI/OE-BRIT-02	4	100
Total			**20**	**500**
Grand Total			**144**	**3850**

(BRIT)

HUMAN ANATOMY

B. Sc. Semester I (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

S.No.	Topics To Be Covered	Teaching Hours

UNIT-1	**Introduction: human body as a whole** Definition of anatomy and its subdivisions Anatomical nomenclature and terminology (planes &positions) Surface Anatomy of main structures and vessels	4
	Applied anatomy& Joints Musculoskeletal system Connective tissue & its modification, tendons, membranes, special connective tissue. Bone structure, blood supply, growth, ossification, and classification. Muscle classification, structure and functional aspect. Joints classification, structures of joints, movements, range, limiting factors, stability, blood supply Nerve supply, dislocations and applied anatomy	4
UNIT- 2	**Extremity (Lower & Upper extrimities)** Bony architecture Joints – structure, range of movement Muscles – origin, insertion, actions, nerve supply Major nerves – course, branches and implications of nerve injuries Development of limb bones, muscles and anomalies Radiographic identification of bone and joints Applied anatomy	4
	Lower extremity Bony architecture Joints – structure, range of movement Muscles – origin, insertion, actions, nerve supply Major nerves – course, branches and implications of nerve injuries Development of limb bones, muscles and anomalies Radiographic identification of bone and joints Applied anatomy	4
UNIT- 3	**Spine and thorax** Back muscles -Superficial layer Deep muscles of back, their origin, insertion, action and nerve supply. Vertebral column – Structure & Development, Structure & Joints of vertebra. Thoracic cage	4
	Head and neck: Cranium Facial Muscles – origin, insertion, actions, nerve supply Temporal mandibular Joints – structure, types of movement	4

UNIT- 4	**Cardiovascular system (with relevant applied anatomy)** Heart-Size,location, chambers. Circulation -Systemic &pulmonary Great vessels of the heart, branches of aorta. Overview of blood vessels of upper extremity and lower extremity	4
	Lymphatic system- (with relevant applied anatomy) Salient features of lymphatic organs (spleen, tonsil, thymus, lymph node)	4
UNIT- 5	**Gastro-intestinal system (with relevant applied anatomy)** Partsofthe gastrointestinal tract Gross anatomy of Tongue, stomach, small and large intestine, liver, gall bladder Pancreas and other digestive organ& related applied anatomy	4
	Respiratory system (with relevant applied anatomy) Partsof respiratory system with salient gross features of lung Brief description of intercostal muscles andPara-nasal air sinuses	4

(For BRIT)

ANATOMY PRACTICAL

B. Sc. Semester I (Course Name.)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

1) Identification and description of all anatomical structures.
2) Demonstration of dissected parts (upper extremity, lower extremity, thoracic & abdominal viscera, face and brain).
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.

(BRIT)

HUMAN PHYSIOLOGY

B. Sc. Semester I (BRIT)

L	T	P	Credits		
3	1	-	4	**Examination:**	**60 Marks**
				Int. Assessment:	**40 Marks**
				Total:	**100 Marks**
				Duration of Examination:	**3 Hours**

UNIT-1	General Physiology Cell: morphology, Structure and function of cell organelles Structure of cell membrane	2
	Transport across cell membrane Intercellular communication Homeostasis	2
	Blood Introduction-composition & function of blood	2
	W.B.C., R.B.C., Platelets formation & functions, Immunity	1
	Plasma: composition, formation & functions, Plasma Proteins: -types & functions, Blood Groups-types, significance, determination.	2
	Hemoglobin, Haemostasis	2
	Lymph-composition, formation, circulation & functions	2
UNIT-2	Cardiovascular system Conducting system-components, impulse conduction Heart valves Cardiac cycle-definition, phases of cardiac cycle,	2
	Cardiac output-definition, normal value, determinants.	1
	Stroke volume and its regulation.	2
	Heart rate and its regulation: Arterial pulse, Blood pressure-definition, normal values, factors affecting blood pressure.	2
	Shock-definition, classification, causes and features, Basic idea of ECG, Cardiovascular changes during exercise	2
UNIT-3	Respiratory System Mechanics of respiration Lung volumes and capacities	2
	Pulmonary circulation, transport of respiratory gases	2
	Factors affecting respiration, Regulation of respiration-neural regulation, voluntary control and chemical regulation	2
	Hypoxia, Hypercapnoea, Hypocapnoea,	1
	Artificial respiration	1
	Disorders of respiration- dyspnoea, orthopnoea, hyperpnoea, hyperventilation, apnoea, Tachypnoea, Respiratory changes during exercise.	2
UNIT-4	Digestive System Digestion & absorption of nutrients, Gastrointestinal secretions & their regulation Functions of Liver & Stomach	2

UNIT-5	Nervous system Introduction, central and peripheral nervous system, functions of nervous system.	1
	Reflexes-monosynaptic, polysynaptic, superficial, deep &withdrawal reflex Sense organ, receptors, electrical& chemical events in receptors.	2
	Sensory pathways for touch, temperature, pain, proprioception & others.	2
	Control of tone & posture: Integration at spinal, brain stem, cerebellar, basal ganglion levels, along with their functions.	1
	Motor mechanism: motor cortex, motor pathway: the descending tracts - pyramidal & extrapyramidal tracts-origin, course, termination & functions. Upper motor neuron and lower motor neuron paralysis. Special senses-eye, ear, nose, mouth	2
	Water excretion, concentration of urine-regulation of Na+, Cl-, K+ excretion	1
	Nerve Muscle Physiology Muscles-classification, structure, properties, Excitation, contraction, coupling, Motor unit, EMG, factors affecting muscle tension, Muscle tone, fatigue, exercise .	2
	Nerve – structure and function of neurons, classification, properties Resting membrane potential & Action potential their ionic basis, All or None phenomenon Neuromuscular transmission Ionic basis of nerve conduction.	2
	Concept of nerve injury &Wallerian degeneration Synapses. Electrical events in postsynaptic neurons Inhibition & facilitation at synapses .	2
	Chemical transmission of synaptic activity Principal neurotransmitters. Chemical transmission of synaptic activity Principal neurotransmitters.	1

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GENERAL MICROBIOLOGY & PATHOLOGY
B. Sc. Semester I (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

MICROBIOLOGY

UNIT-I

Safety measures in laboratory

Sterilization and Disinfection: Physical Methods of Sterilization, Chemical Methods of Sterilization, Methods of Disinfection

Normal microbial flora of human body, role of normal flora

UNIT-II

Introduction and morphological features of Bacteria, Fungi, Viruses, Parasites, Microbial pathogenicity
Brief Introduction of morphology and diseases associated with of, Streptococcus pneumoniae, Mycobacterium, Aspergillus, Tinea, Mycetoma, Cryptococcus.

PATHOLOGY

UNIT-III

Basic Pathology: Pathology & its branches

Normal cell and its functions, Various types of microscope & light microscope in details.

UNIT-IV

Formation of Blood, Composition and functions of blood, Various anticoagulants, their uses, mode of action and their merits & demerits.Normal hematological indices (MCV, MCH, MCHC, PCV)

Normal and absolute values in hematology, ESR & Factors influencing ESR and various procedures for its estimation.

(BRIT)

Radiation Physics & fundamental of medical imaging

B. Sc. Semester I (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**Exposure switches and Timer / AEC** Exposure switches and relays timers and its radiographic application. Electronic Timers; Automatic Exposure Control Timers, Phototimer	4

	Beam limiting devices, Absorption co-efficient, grids, cones and filter.	2
	General Physics & Electric circuit Electrical charges, potential difference, current and resistance. Ohms Law for electrical circuit, direct current, alternating current, conductors, semiconductors, insulators, power, ammeter and voltmeter.	
	Electromagnetism Electromagnetic Induction: Self and Mutual, Capacitor, capacitance	
	Electric supply & Distribution; diagnostic X-Ray circuits- X-Ray Tube	
UNIT-2	**X-ray generator** **Transformers** Types of transformers, Generator & its type	
	The Tube Stand and Control of panel: Rectification; diodes and rectifiers, semiconductors, Incoming light circuits (Phases – Single & Triple Phase modes, Three Phase 6-pulse mode, Three phase 12- pulse mode; Specialized X-Ray Generators, **capacitor discharge generator** & Transformers.	
	Basic X-Ray circuits transformers laws and types used in X-Ray machine. The rectification of high tension, control of kilovoltage, filament circuit and tube current	
UNIT-3	**History of x-ray** **Production of x-ray & its property** **Interaction of x-ray with matter** **Attenuation**	
UNIT-4	**X-Ray Tubes** **Construction of various x-ray tube & handling** Fixed and rotating anode, faults in X-Ray tubes, Grid Controlled X-Ray Tube, Mammography X-Ray Tube.	4
	Heavy Duty X-Ray Tube, Micro-Focus X-Ray Tube; Tube Rating and Tube Support- Tube heat Ratings	4
	Advancement of X-ray tube	
	Line Focus principle, Anode Cooling chart, Type of X-Ray Tube Stands	2
	Tube overload indication, X-Ray Tube over Load Protection Circuits, Grid, Heel effect, Beam limiting devices	2
UNIT-5	Introduction & Handling of Portable and Non- Portable equipment	2
	Care and maintenance Maintenance and care of all X-Ray equipment and accessories	6

(For BRIT)

Radiation Physics & fundamental of medical imaging

B. Sc. Semester I (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

1) X-Ray tubes and accessories, general features.
2) Portable X-Ray Equipment.
3) Image intensifier, its features, spot film.
4) Radiation protection devices
5) Effects of kV and mAs.
6) Maintenance of X-ray equipment and accessories.
7) Mammography X-Ray tube
8) Dental X-Ray unit.

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Communication Skills and Personality Development

B. Sc. Semester I (BRIT)

L	T	P	Credits		
3	1	-	4	**Examination:**	**60 Marks**
				Int. Assessment:	**40 Marks**
				Total:	**100 Marks**
				Duration of Examination:	**3 Hours**

Sl. No	TOPICS TO BE COVERED	Teaching Hours

Unit-I	Listening Comprehension • Speeches • Interviews • audio-video clippings followed by exercises • Introduction to Communication • Importance of Communication • Barriers to Communication and ways to overcome them	10 hours
Unit-II	Conversation Skills • Greetings and Introducing oneself • Framing questions and answers • Role play • Buying: asking details etc • Word formation strategies • Vocabulary building: Antonyms, Synonyms, Affixation, Suffixation, One word substitution	8 Hours
Unit-III	Reading Comprehension • Simple narration and Stories • Newspaper and articles clippings • Sentence types • Note Making • Paragraph Writing • Comprehension • Report Writing: types, characteristics	12 Hours

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HUMAN Anatomy - II

B. Sc. Semester II (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**Urinary system (with relevant applied anatomy)**	6

	Parts of urinary system Salient gross features of kidney, urinary bladder, ureter and urethra.	
UNIT-2	**Reproductive system** Parts of male and female reproductive system with salient gross features of testis & uterus, ovary and fallopian tube	8
UNIT-3	**Endocrine glands** List of the endocrine glands, their position and salient gross features Hormones produced by each endocrine glands **Embryology** Spermatogenesis & oogenesis Ovulation,fertilization, Placenta, Fetalcirculation	6
UNIT-4	**Nervous system** Classification of the nervous system, Definitions of central, peripheral and autonomic nervous system Neuron- structure and classification, neuroglia Names of lobes of Cerebrum and cerebellum, Parts of brainstem (salient features only) .Cerebrospinal fluid and its circulation, names of cranial nerves, spinal nerve, meninges, ventricles (salient features only)	8
UNIT-5	**Sensory organs** Skin: Its appendages and functions Eye: Parts of eye and its structure Ear: Parts of ear- external, middle and inner ear and contents**..**	6

(For BRIT)

HUMAN ANATOMY PRACTICAL

B. Sc. Semester II (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

5) Identification and description of all anatomical structures.

6) Demonstration of dissected parts

7) Demonstration of skeleton-articulated and disarticulated.

8) Surface anatomy: Surface land mark-bony, muscular and ligamentous. Surface anatomy of major nerves, arteries of the limbs.

(BRIT)

Physiology - II

B. Sc. Semester II (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**Renal System** Physiology of kidney and urine formation Glomerular filtration rate, clearance, Tubular function	6
UNIT-2	**Physiology of urinary bladder and urethra** Ureter, bladder, urethra	6
UNIT-3	**Digestive System** Digestion & absorption of nutrients, Gastrointestinal secretions & their regulation Functions of Liver & Stomach	8
UNIT-4	**Endocrinology** Physiology of the endocrine glands – Hormones secreted by these glands	2
	Their classifications and functions.	2
	Adrenal, Gonads	2
	Thymus, Pancreas.	2
	Pituitary,	2
	Pineal Body,	2

	Thyroid, Parathyroid	2
UNIT-5	**Male & female reproductive system** Male -Functions of testes, pubertal changes in males,	2
	Testosterone -action & regulations of secretion.	2
	Female -Functions of ovaries and uterus, pubertal changes, Menstrual cycle, estrogens and progestron -action and regulation	2

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Image Acquisition, Processing & Archiving

B. Sc. Semester II (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	X-ray film and Image processing Composition of single and double coated radiographic films, Screen & Non Screen films, structure of film, characteristic curve. Characteristics (speed, base + fog, gamma, latitude).	2
	Effect of grain size on film response to exposure, interpretation of characteristics curve, latent image formation, process of film developing (composition of developer, Fixer and other processing solution).	2
	Common errors and faults while processing (densitometry), automatic processing unit (processing cycle), developer & Fixer replenishment and silver recovery	2
UNIT-2	Film storage and handling Film storage rules and guidelines, film handling and care	2
	Intensifying screens and cassettes Size, construction and function, types of intensifying screens 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	2
UNIT-3	Image Processing Image formation, latent image, processing: manual processing, automatic processing.	4
	Developer, fixer, rinser components, replenisher.	2
	Manual technique of developing film	2
	Automatic film processor	2
	Common errors in processing	2

UNIT-4	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 with respect to visual assessment	5
UNIT-5	Dark Room Introduction, purpose and location of dark room, layout of dark room,entrance, pass box, hatch, hangers, safe light, criteria of safe light, safe light test	5
	DICOM Introduction, advantages, disadvantages	1
	Digital Radiography & Computed Radiography Introduction, advantages, disadvantages	2
	PACS, Teleradiology Introduction, advantages, disadvantages (Functions with HIS/RIS)	4

(For BRIT)

Image Acquisition, Processing & Archiving

B. Sc. Semester II (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

Topic
○ Loading and unloading of X-ray Films ○ Technique, Safety concern, Handling in loading and unloading films ○ Dark Room Procedures ○ Developer, fixer content. Developing technique, Fixing technique ○ Safe light test ○ Safe light principal, benefits and its location ○ Cleaning & maintenance of Cassette. ○ Safe and hygienic handling of cassettes and maintenance ○ Light leakage test in Cassettes ○ Cassettes safety and image quality features ○ Handling and storage of X-ray Film & Film Boxes ○ Handling of X-ray films, easy to achieve locations, safe places of storage. ○ Using techniques of films by size of open boxes ○ Editing images in CR & Taking prints ○ Application of CR, its instrumentations, DRY and Laser printer, CR Printer's application. ○ DICOM ○ Application, Functions, Features and its advantages. ○ Automatic processor ○ Application, principal. Working technique, work load handling in automatic processor.

(BRIT)

General Radiography Positioning & terminology- I (Theory)

B. Sc. Semester II (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**Role of Radiographer in Hospital practice and Patient care** Appearance of radiographer, behaviour of radiographer, professional conduct, code of ethics Handling of emergency patient, Steps for handling MLC case atient	2
UNIT-2	**All View and techniques of Chest radiography which must includes indication, contra indication, prepration, technique.** **Chest** ROUTINE, PA, Lateral, SPECIAL, AP supine or semierect, Lateral decubitus, AP lordotic, Anterior oblique, Posterior oblique,	2
	Upper Airway ROUTINE, Lateral, AP,	1
	Sternum ROUTINE, RAO, Lateral,	1
	Sternoclavicular Joints ROUTINE, PA, oblique,	1
	Ribs ROUTINE, Posterior ribs (AP) or anterior ribs (PA)— bilateral study, • unilateral rib (AP/PA) study, axillary ribs (anterior or posterior oblique) • PA chest	2
UNIT -3	**All Views and techniques of Upper Limb Fingers** ROUTINE, PA, PA oblique, Lateral	2
	Thumb ROUTINE, AP, PA oblique, Lateral, SPECIAL • AP, Modified Robert's method, PA stress (Folio method) projection	2
	Hand, ROUTINE • PA, PA oblique, Lateral (fan), Lateral (extension and flexion),	2

	SPECIAL • AP oblique bilateral (Norgaard method),	
	Wrist ROUTINE • PA (AP), PA oblique, Lateral SPECIAL • Scaphoid views- CR angle, ulnar deviation, • Modified Skecher method, • Radial deviation, • Carpal canal inferosuperior, Carpal bridge, Ball catcher view,	2
	Forearm, ROUTINE • AP, Lateral	1
	Elbow Joint ROUTINE • AP, Fully extended, Partially flexed, AP obliques, Lateral (external) rotation, Medial (internal) rotation, Lateral, SPECIAL • Acute flexion (Jones method), Trauma axial laterals (Coyle method), • Radial head laterals,	2
	Humerus, ROUTINE • AP, Rotational lateral, Horizontal beam lateral	1
	HUMERUS & SHOULDER GIRDLE Humerus (Nontrauma Routine) ROUTINE • AP, AP rotational lateral, Horizontal beam lateral, SPECIAL • Transthoracic lateral, Shoulder (Non trauma Routine) ROUTINE • AP external rotation (AP), AP internal rotation (lateral), SPECIAL • inferosuperior axial (lawrence method), PA transaxillary (Hobbs modification), • inferosuperior axial (Clements modification), Posterior oblique— glenoid cavity (Grashey method), Tangential projection— intertubercular groove (Fisk modification)	2
	Shoulder (Trauma Routine)	2

	ROUTINE • AP neutral rotation (AP), Transthoracic lateral (lawrence method), • Scapular Y lateral, SPECIAL • Tangential projection— supraspinatus outlet (neer method), • AP apical oblique axial (Garth method),	
	Clavicle ROUTINE • AP, AP axial,	1
	AC Joints ROUTINE • AP bilateral with weights, AP bilateral without weights,	1
	Scapula ROUTINE • AP, lateral, erect, Recumbent	2
UNIT-4	**All Views and techniques of Lower Limb** **Toes** ROUTINE • AP, oblique, Lateral, SPECIAL • Sesamoids (tangential)	2
	Foot ROUTINE • AP, oblique, Lateral, SPECIAL • AP and lateral weight-bearing,	2
	Calcaneus ROUTINE • Plantodorsal (axial), Lateral,	1
	Ankle ROUTINE • AP, AP mortise (15°), Lateral, SPECIAL • oblique (45°), AP stress,	2
	Leg ROUTINE • AP, Lateral, Knee	2

	ROUTINE • AP, oblique, Lateral, SPECIAL • AP (PA) weightbearing, PA axial weightbearing (Rosenberg method)	
	Knee—Intercondylar Fossa ROUTINE • PA axial (Camp Coventry and Holmblad methods with variations), SPECIAL- AP axial,	1
	Patella and Femoro-Patellar Joint ROUTINE • PA, Lateral, Tangential (Merchant method), • Tangential (inferosuperiorprojection; Hughston, Settegast, and superoinferior sitting tangential methods- Hobbs)	2
Unit-5	**Dental Radiography** Introduction, oral radiography (Intra & extra), bitewing, periapical, panoramic imaging- OPG cephalometry etc. **Ward radiography** **All bedside radiography**	

(For BRIT)

General Radiography Positioning & terminology- I (Theory)

B. Sc. Semester II (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

Topic

Regional Radiography:

a. All Views and techniques of Upper Limb: Fingers, Hand, Carpal Tunnel, Wrist Joint, Ball catcher view,Forearm, Elbow Joint, Head of Radius and Ulna, Humerus, all view of Shoulder joint like Acromio-clavicular joint, Scapula, Sterno – Clavicularjoint etc.

b. All Views and techniques of Lower Limb: Toes, Foot,Calcaneum, Inter-condylar Notch, Ankle Joint, Tibia and Fibula, Patella, Knee joint, Femur.

c. All View and techniques Chest: lung fields and heart, diaphragm, Sternum,

(BRIT)

FUNDAMENTALS OF COMPUTER SCIENCE-II

B. Sc. Semester II (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

1. Languages: Machine Language, Assembly Languages, Programming Languages. Use of Compilers, Assemblers, Linkers, Loaders and interpreters in programming languages
2. Operating System: Booting/Start Up Procedure of machines, Introduction to Operating System, Functions and Classification of Operating Systems, Basic introduction to DOS, UNIX/LINUX OS, Windows
3. HTML, Use of Multimedia, Computer aided teaching and testing

Application Software MS office (Word, Excel and Powerpoint)

4. **Basic Introduction to Computer Networks:**

Data Communication, Network devices (Hub, Switches, Modems, and Routers etc), LAN, LAN topologies, WAN, MAN, Internet: Introduction, Basics of E-mail, Web browsers (IE, Google Chrome, and Mozilla Firefox),

5. Structure of Universal Resource Locator, Domains (.com, .in, .country specific, .org and rationale behind them), IP address, Backbone network, Network connecting devices, HTTP, DNS, Network Security and Search Engine.

(BRIT)

General Radiography Positioning & terminology- II (Theory)

B. Sc. Semester III (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**All Views of Hip and Pelvis** **Pelvis and/or Bilateral Hips** ROUTINE Mid- and distal femur: • AP projection, lateral projection, AP pelvis or bilateral hips, AP bilateral frog-leg, (modified cleaves method) SPECIAL, AP axial outlet projections, (Taylor method), AP axial inlet projection, Posterior oblique acetabulum, (Judet method). Posterior axial oblique acetabulum, (Teufel method)	4
	Hip and Proximal Femur ROUTINE • AP unilateral hip, TRAUMA LATERAL • axiolateralinferosuperior (Danelius-Miller method), SPECIAL NONTRAUMA LATERAL • unilateral frog-leg (modified cleaves method), SPECIAL TRAUMA LATERAL • Modified axiolateral (clements-nakayama method)	2
UNIT-2	**All Views and techniques of Skull** **Skull Series** ROUTINE • AP axial (Towne method), lateral, PA axial 15° (Caldwell method) or	2

	PA axial 25° to 30°, PA 0°, SPECIAL • submentovertex (SMV), PA axial (Haas method),	
	Facial Bones (Orbits) ROUTINE • lateral, Parietoacanthial (Waters method), PA axial (Caldwell method), SPECIAL • modified Parietoacanthial (modified Waters method),	1
	Nasal Bones ROUTINE • lateral, Parietoacanthial (Waters method), SPECIAL • superoinferior (axial),	2
	Zygomatic Arches ROUTINE • submentovertex (SMV), • oblique inferosuperior (tangential), • AP axial (modified Towne method), • PA parietoacanthial (Waters method),	2
	Optic Foramina and Orbits ROUTINE • Parieto-orbital oblique (rhese method), • Parietoacanthial (Waters method), SPECIAL • modified parietoacanthial (modified Waters method),	2
	Mandible ROUTINE	2

	• axiolateral oblique, PA 0° and 20° to 25° cephalad, AP axial (Towne method), SPECIAL • submentovertex (SMV), • Orthopantomography (panoramic tomography),	
	TMJs ROUTINE • AP axial (modified Towne method), SPECIAL • axiolateral 15° oblique (modified law method), • axiolateral (schuller method),	2
	Paranasal Sinuses ROUTINE • lateral, PA (Caldwell method), Parietoacanthial (Waters method), SPECIAL • submentovertex (SMV), Parietoacanthial transoral (open mouth Waters method),	2
UNIT- 3	**All Views and techniques of Vertebral Column** **Cervical Spine** ROUTINE • AP open mouth (C1 and C2), AP axial, oblique, lateral, lateral, horizontal beam, SPECIAL • Cervicothoracic lateral (Twining method, swimmer's technique), • lateral hyperflexion and hyperextension, AP (Fuchs method) and PA (Judd method), AP "wagging jaw" (ottonello method), AP axial (pillar),	4

	Thoracic Spine ROUTINE • AP, lateral, SPECIAL- oblique,	1
	Lumbar Spine ROUTINE • AP (or PA), obliques—posterior or anterior, Lateral, Lateral L5-S1, SPECIAL • AP axial L5-S1,	2
	Scoliosis Series ROUTINE • PA (AP)—erect and/ or recumbent, erect lateral, SPECIAL • AP (Ferguson method), AP (PA)—R and L bending,	2
	Spinal Fusion Series ROUTINE • AP(PA)—R and L bending (same as for scoliosis series), • Lateral— hyperextension and hyperflexion,	1
	Sacrum and Coccyx ROUTINE • AP axial sacrum, AP axial coccyx, Lateral sacrum, Lateral coccyx,	2
	Sacroiliac (SI) Joints ROUTINE • AP axial, Posterior oblique,	1
UNIT-4	**All views and techniques Abdomen** **Abdomen (KUB)**	2

	ROUTINE • AP supine, SPECIAL • PA prone, Lateral decubitus (AP), AP erect, dorsal decubitus (lateral), • Lateral,	
	Acute Abdomen (Three-Way, with PA Chest) ROUTINE • AP supine, AP erect, PA chest erect, SPECIAL • Left lateral decubitus (AP),	2
UNIT-5	**Skeletal Survey** All views required for skeletal survey, **OT Radiography & instrumentation**	2

(For BRIT)

General Radiography Positioning & terminology- II

B. Sc. Semester II (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

Topic

Regional Radiography:.

a. All Views of Hip and Pelvis: Theatre procedure for Hip, Pinning and Reduction, Pelvis, Sacro-ilac Joint, Pelvis Bone, Acetabulum**.**

b. All Views and techniques of Skull: Cranium, facial bones, temporal bones,temporo-mandibular joints, mandible, Paranasal Sinuses.

c. All Views and techniques of Vertebral Column: Cervical Spine, Thoracic spine, Lumbar spine, Sacrum, Coccyx

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

(BRIT)

Advance Physics and Instrumentation in Digital imaging

B. Sc. Semester III (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**Role of Mammography in Imaging** History of mammography, Mammographic equipment Mammographic radiation dose and exposure	2
	Dedicated mammographic unit and its special features Types of mammography, Routine Mammographic Positioning & Views with additional views and technical considerations Wire localization in mammography BI-RADS Term, Limitation of mammography	4
UNIT-2	Beam limiting Device in mammography Radiation Hazard, prevention, protection and Safety in Breast Imaging Film screen mammography, Digital mammography, USG Guided FNAC & Biopsy of Breast's abnormal collection or tissue	2
UNIT-3	Introduction of DEXA Equipment of DEXA Role of DEXA in osteopenia & osteoporosis Recommendation of WHO for calculating T-score & z-score in case of various condition.	
UNIT-4	Xero radiography, Copying/Duplication radiography	

UNIT-5	**Fluoroscopy (conventional & IITV) and** C-arm **its principle & construction** Conventional Tomography, CR, Digital Fluoroscopic & DR **Role of AI in modern imaging- ML, DL etc.** QA & QC of each equipment- Purpose, benefits and record maintain	

(BRIT)

Ultrasound, Doppler including 4D & Echocardiography

B. Sc. Semester III (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT- 1	**Ultrasound** Principle & history of Ultrasound, advantages and disadvantages of ultrasound, Types of Ultrasound, Equipment description	2
	Mode of USG & its type	
	Indication and Clinical Application	2
	Physics of ultrasound imaging, Physics of transducers, **construction & its type,** Physics of Doppler USG & its type	2
	Ultrasound tissue characterization	2
	Potential for three dimensional ultrasound	2
UNIT-2	Artifacts in ultrasound	2
	Comparison of ultrasound equipment Computerization of data, Image recording,	1
	Ultrasound jelly & Safety of ultrasound	2
	Role of AI in modern diagnostic radiology	
	Tissue harmonic imaging	
UNIT-3	**Clinical application of USG**	

	Abdomen and pelvis ultrasound Pathologies and indications, patient preparation, positioning and scanning technique Role of USG elastography & its technique	2
	Orbit, Neck, Sub-mandibular gland, Thorax, Breast, & Scrotum Pathologies and indications, patient preparation, positioning and scanning technique	4
	Color Doppler imaging, The obstetric Ultrasound examination Method of gynecologic ultrasound examination, Assessment of Normal fetal growth, fetal behavior states, fetal breathing movements, fetal cardiac activity	5
UNIT-4	**USG Contrast Media** Types of Ultrasound Contrast media and its advantages **Care & maintenance QA & QC & USG equipment**	5
UNIT-5	Echocardiography Equipment, Introduction, indication and image formation.	4
	Uses of color Doppler in echocardiography and equipment description with transducer	4

(For BRIT)

Ultrasound, Doppler including 4D & Echocardiography

B. Sc. Semester III (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

PRACTICAL

USG: Equipment, Transducer, Applications of various procedures in well-equipped Hospitalsand Diagnostic Centers

Patient Preparation for ultrasound whole abdomen, upper abdomen, lower abdomen (pelvis), Obstetrics (pregnancy) Level- I & II

Contrast media in USG

Imaging of mammography, positioning, all views, operation of mammography equipment,types of film and screen in mammography.

Echocardiography: Indication and image formation. Uses of color Doppler inechocardiography and equipment description with transducer

(BRIT)

Radiation biology and its Hazards & Protection

B. Sc. Semester III (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**National & international regulatory agency** Principles, history & development- National & international agencies, AERB, BARC, ICRP, WHO, IAEA and their role.	2
	AERB safety code and ethics **Guideline of AERB for installation of x-ray or CT unit** Built in safety specifications for diagnostic x-ray, Fluoroscopy and CT units X-ray examinations associated with illness, not associated with illness, medico-legal or insurance purpose x-ray examination, medical research x-ray avoidance of unnecessary radiation dose	4
UNIT-2	**Radiation Units & Quantities** Principle of radiation protection (Justification, optimization (ALARA), dose limit) Cardinal principle, KERMA, Equivalent dose, Effective dose, Absorbed dose, MPD Tissue weighting factor, Exposure-Roentgen, RBE, LET & its type, Radiation weighting factor. Concepts of workload use factor occupancy factor & distance. Specifications for radiation protection devices-room layout.	4
	Operational safety-Radiation protection programme	2
Unit-3	**Biological effects of radiation & emergency** Interaction of radiation with tissue, cellular radio biolopgy, response of organ system to radiation. Effects on cell-stochastic & deterministic effects-radiation risk-tissues at risk-genetic, somatic & fetus risk-risk at other industries, Acute radiation syndrome, radiation induced, carcinogenesis, hereditary effect, cell survival, radiation exposure & tissue doses	6
UNIT -4	**Planning of diagnostic equipment installation** Planning of x-ray equipment installation, layout, design as per regulatory guidelines.	8

	Barrier design barrier materials-concrete, brick & lead. Primary & secondary barrier design calculations. Design of doors. protection from primary, secondary radiation Leakage and scattered radiation.	4
UNIT-5	**Personnel Monitoring & protective Devices** Personnel monitoring systems Principle and objective-film badge: guidelines for use thermo-luminescent dosimeter badge-pocket dosimeter, OSLD Area monitoring and radiation survey Practical use of survey meter, GM counter, Gas ionization, zone monitors and phantoms. Survey in x-ray, fluoroscopy and CT scan units, Responsibility of RSO Protective Devices includes: shielding devices like lead apron, gloves, thyroid shield, gonadal sheath, goggles, lead barrier, etc. .	

(For BRIT)

Radiation biology and its Hazards & Protection

B. Sc. Semester III (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

1) Knowledge of all hazards, education of general Public by posters and seminars
2) Safety of women and children , pregnant women, safety of patient attendants, radiation workers and hospital staff, checking of lead aprons, leakage radiation from tube head, radiation survey in and around X – ray installation.
3) Use of TLD film badges, GM counters, Scintillation detectors, Liquid scintillator, Pocket dosimeters and use of protective devices etc. Keeping of dose records of radiation workers, steps after high exposure report and investigations.
4) Biological effects of radiation- The cell effect of ionizing radiation on cell. Somatic effects and hereditary effect. Stochastic and deterministic effect.

5) Use of TLD film badges, GM counters, Scintillation detectors, Liquid scintillator, Pocket dosimeters and use of protective devices etc. Keeping of dose records of radiation workers, steps after high exposure report and investigations.
6) Biological effects of radiation- The cell effect of ionizing radiation on cell. Somatic effects and hereditary effect. Stochastic and deterministic effect.

Quality Assurance & Quality Control

7) Quality control tests for X-ray unit.
8) Quality control tests for radiation leakage
9) Quality control tests for cassettes
10) Quality control tests for radiation shielding devices.

(BRIT)

ENVIRONMENTAL STUDIES

B. Sc. Semester III (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

Unit 1:

The Multidisciplinary nature of environmental studies

- Definition, scope and importance.
- Need for public awareness.

Natural Resources

Renewable and non-renewable resources: Natural resources and associated problems.

- Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Unit 2:

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.

- Ecological succession.
- Food chains, food webs and ecological pyramids.

Biodiversity and its conservation

- Hot-spots of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts
- Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit 3:

Environmental Pollution

Definition, causes, effects and control measures of:-

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
- Fireworks, their impacts and hazards
- Pollution case studies.
- Disaster management : floods, earthquake, cyclone and landslides.

Unit 4 :

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.
- Consumerism and waste products.
- Environmental Legislation (Acts and Laws)
- Issues involved in enforcement of environmental legislation

Human Population and the Environment

- Population growth, variation among nations with case studies
- Population explosion – Family Welfare Programmes and Family Planning Programmes
- Human Rights.
- Value Education.

- Women and Child Welfare.

(BRIT)

Medical Emergencies & Patient Care

B. Sc. Semester IV (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

Unit – I: Introduction to Emergency Services

Organization of Emergency Department, Guidelines in Emergency, Clinical Monitoring, Fluid Therapy and Blood Transfusion, Airway Management, Cardiopulmonary Resuscitation, Principal of Mechanical Ventilation, Injection – An Infusion Method, Acid Base and Electrolyte Imbalance

Unit – II: Handling of Different Emergencies

Cardiogenic Shock, Congestive Cardiac Failure, Myocardial Infarction, Head Injuries, Vasovagal Syncope, Seizer, Epilepsy, Conjunctival and Corneal Foreign Body, Foreign Body in Nose & in Ear, Epistaxis, Asthma, COPD, Haemoptysis, Rib Fracture, Tear Gas Exposure, Food Poisoning, Diarrhea, Urine Retention, Blunt Scrotal Trauma, Hypo & Hyperthermia

Unit – III: Fundamentals of Patient Care

Concept of health & Illness, Health Determinants, Concept of Patients & Their Types, Patient Centred Care & Fundamentals of Communications, Reporting & Recording of Patients, Rights of Patients , Concepts of Disease & Its Types, General Concept, Care & Prevention of Accident, Trauma & Infections

Unit – IV: Patient Care, Associated Units & Departments

Ambulatory Units, Critical Care Units ,Paediatric, Neonatal Intensive Care Unit (NICU), Emergency Department, Inpatient Units, Haematology/Oncology and Immunology

Unit , Orthopaedic Unit, Psychiatry Unit ,Neurology and Neurosurgical Unit, Renal, Dialysis Unit, Gastroenterology/Endocrinology Unit, Life Flight Critical Care Transport Program, Radiology Department, Surgical Units, Cardiac Catheterization Lab, Operating Room, Post Anaesthesia Care Unit, Managing patients with disabilities, Geriatric Care, Care of Critically Ill Patients, Tracheotomise Patients. Nutritional Support in ICU

(BRIT)

Computed Tomography -Basic principle and techniques (Theory)

B. Sc. Semester IV (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	C.T. Scan Basic principle of CT scan history of CT Scan	Must Know	6
	EMI- History, System design etc		
	CT Equipment description & Instrumentation CT gantry, patient table, CT computer & image processing system, image display, storage & recording, CT control console, other accessory		
	Computed Tomography Scanning principle	Must Know	6
	Data acquisition, Data processing, Image display		
	Image reconstruction & its types		
	Image manipulation & Post processing Introduction, clinical use, advantages, disadvantages of MPR, MIP, SSD, CPR, VR		
	Scanning parameters		
UNIT-2	Generation of CT Scanner 1st generation, 2nd generation, 3rd generation, 4th generation, Slip ring technology, spiral/helical scanning, EBCT, Dual source scanning, flat panel detector Advantages and disadvantages	Must Know	6
UNIT-3	**Image Quality in CT** pixel, voxel, Image Brightness, spatial resolution, Contrast resolution, quantum mottle, Sharpness, Window width, Window level, Isotropic Imaging, CT Number, Pitch	Must Know	6
UNIT-4	**CT Scan Radiation Dose & Radiobiology**	Must know	10

	Attenuation of X-ray in tissue, Equivalent dose, effective dose, absorbed dose, tissue weighting factor, Organ dose from X-Ray procedure, CT dosimetry, CTDI, DLP, KERMA, occupany factor, CT phantom, Patient Dose Radiation risk, Risk to generic Patient, Increasing radiation burden from Medical Imaging.		
UNIT-5	**QA & QC of CT scanner & artefacts** Purpose benefit, record maintaining of QA & QC. **Artefacts** Definition, manifestation & Remedy Motion artefact, metal artefact, out of field artefact, beam hardening artefact, partial volume averaging artefact, ring artefact, pitch artefact, stair step artefact,	Must Know	6

(For BRIT)

Computed Tomography -Basic principle and techniques (Theory)

B. Sc. Semester IV (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

1) Physics, scanning principle and image formation in CT

2) Identification of different parts of CT scanner

3) Applications of various procedures in well-equipped Hospitals and Diagnostic Centers

4) Quality control of CT

(BRIT)

Special Investigations & Pathology

B. Sc. Semester IV (BRIT)

L	T	P	Credits		
3	1	-	4	**Examination:**	**60 Marks**
				Int. Assessment:	**40 Marks**
				Total:	**100 Marks**

Duration of Examination: 3 Hours

UNIT-1	**Patient preparation for Special procedure and related contrast Media** Contrast media,	2
	Types of contrast media,	
	Contra indications for contrast media	2
	Reactions to contrast	
	Anaphylactic shock	
	Myocardial Infarction.	2
	Emergency in Radiology Department	
	Emergency drugs and its dose	
UNIT-2	**Excretory System** Introduction, pathology of urinary system, indications, apparatus, procedure and patient care.	2
	Intravenous pyelography/Intravenous Urography	2
	Retrograde Urethrography	2
	Micturation Cysto-Urethrography	2
	Percutaneous nephorostomy	2
UNIT-3	**Special Procedures** Introduction, pathology of biliary tree, indications, apparatus, procedure and patient care.	2
	Oral Cholecystography	1
	Percutaneous Transhepatic Cholangiography	
	T-Tube Cholangiography	
	Bronchography	1
	Arthrograpgy	1
	Myelography	1
	Dacrocystography (DCG)	1
	Endoscopic Retrograde Cholangio Pancreatography	1
	Sialography	1
UNIT -4	**G.I.Tract** Introduction, pathology of GI tract, indications, apparatus, procedure and patient care.	2
	Barium Swallow	2
	Barium Meal Study	
	Small bowel Enema	
	Barium meal Follow Through	
	Barium Enema	
	Double Contrast Studies	
	Gastro-graffin study, Hypotonic duedonography, defecography, Entroclysis	
UNIT-5	Introduction, Indications, Contraindications, Apparatus, Procedure technique and Patient Care-	2

	Hysterosalpingography (HSG), High K.V Technique, Soft tissue Radiography, Air gap technique,	2
	Miscellaneous Discography, Myelography, Harniogram, Pouchogram, loopogram, invertogram, Scanogram, Fistulogram, sinogram, Arthrography, Pelvimetery, Forensic Radiography Foreign bodies Radiography, soft tissue radiography, high kVp radiographic technique. Micro & Macro radiography	
	Care and maintenance Maintenance and care of all X-Ray equipment and accessories	

(For BRIT)

SPECIAL INVESTIGATIONS & PATHOLOGY

B. Sc. Semester IV (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

Topic
1. Radiography in various positions for all the special radiological procedures, using contrast media
2. Identification of various films for all the special radiological procedures, using contrastmedia and related pathologies

(BRIT)

Nuclear Medicine & PET Scan

B. Sc. Semester IV (BRIT)

L	T	P	Credits		
3	1	-	4	**Examination:**	**60 Marks**
				Int. Assessment:	**40 Marks**

Total: **100 Marks**

Duration of Examination: 3 Hours

UNIT-1	**Nuclear Medicine** Role of Artificial intelligence in nuclear medicine & its future Applications and Apparatus for nuclear medicine Introduction of Radioactivity & its decay type Electromagnetic spectrum Law of radioactivity	3
UNIT-2	**Gamma Camera** Application, Function and instrumentation	6
UNIT-3	**SPECT** Definition	2
	Applications	3
	Clinical uses, advantages & disadvantages	2
UNIT-4	**PET CT & PET MRI** **Instrumentation of PET & its uses** Benefits vs risk	2
	PET-CT	3
	PET-MRI	3
UNIT-5	**Radionuclides** **Production of radionuclide & its type** **Handling of radionuclide** Characteristics and half-life of Radionuclides.	4
	Commonly used Radionuclides	2
	Protocols- Routine protocols Bone, Thyroid, Kidney, Heart	4
	Indication, contraindications of PET Scans- Indication and contraindications of PET	4
	Patient Preparation- Patient preparation technique in PET Scan	2

(For BRIT)

NUCLEAR MEDICINE & PET SCAN

B. Sc. Semester IV (BRIT)

L	T	P	Credits
-	-	2	

Examination: **30 Marks**

Int. Assessment: **20 Marks**

Total: **50 Marks**

1. Nuclear Medicine
2. Gamma Camera
3. PET CT & PET MRI
4. Radionuclides

(BRIT)

Magnetic Resonance Imaging-Basic principle and techniques (Theory)

B. Sc. Semester IV (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	Introduction of MRI Basic principle of MRI history of MRI	Must Know	10
	Introduction, atomic structure, motion within the atom, Hydrogen nucleus, alignment, precession, Larmour equation, resonance, MR signal, FID, law of electromagnetism	Must know	
	T1 relaxation time, T2 decay time, pulse timing parameter, Extrinsic parameter & Intrinsic parameter.	Must know	
UNIT-2	MRI Equipment description & Instrumentation- Introduction, magnetism, permanent magnet, resistive magnet, superconducting magnet, fringe field, shim coil, gradient coil, RF coil, the pulse control unit, patient transportation system, operator interface	Must know	5
UNIT-3	Image weighting & contrast Introduction, image contrast, contrast mechanism, T1 contrast, T2 contrast, proton density contrast, image weighting, T1 weighting, T2 weighting, proton density weighting	Must Know	5
	Encoding & Image Display Encoding- introduction, gradient, slice selection, frequency encoding, phase encoding gradients, K-space, K-space filling and its role	Must Know	5
UNIT-4	Factors that affect image quality & Trade off Introduction to SNR & CNR, factors effect on SNR & CNR, spatial resolution, scan time, Trade's off	Must know	5
	Artifacts: Introduction, phase mis-mapping, aliasing artifact, chemical shift artifacts, chemical misregistration artifact, truncation artifact, magnetic susceptibility artifact, zipper artifact, shading	Desirable to know	5

	artifact, motion related artifacts, cross excitation or cross talk artifacts		
UNIT-5	Pulse Sequences Introduction of spin Echo pulse sequence-conventional, Fast spin echo, Inversion recovery, Gradient pulse sequence Conventional gradient echo, The steady state, Coherent residual transverse magnetization, incoherent gradient pulse sequence, SSFP, EPI, Balanced gradient	Must Know	5

(For BRIT)

Magnetic Resonance Imaging-Basic principle and techniques (Theory)

B. Sc. Semester IV (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

1) Physics, scanning principle and image formation in MRI
2) Identification of different parts of MR scanner
3) Applications of various procedures in well-equipped Hospitals and Diagnostic Centers
4) MR artefact & its remedy

(BRIT)

MRI Clinical Applications & Imaging Protocols (Theory)

B. Sc. Semester V (BRIT)

L	T	P	Credits		
3	1	-	4	**Examination:**	**60 Marks**
				Int. Assessment:	**40 Marks**

Total: **100 Marks**

Duration of Examination: 3 Hours

UNIT-1	Flow phenomena- Mechanism of flow, time of flight phenomena, entry slice phenomena, intra voxel dephasing Flow phenomena compensation- Introduction, gradient moment rephrasing, pre saturation, even echo rephrasing.	Must Know	5
UNIT-2	Contrast media- Introduction, uses & methodology, mechanism of action, dipole-dipole interaction, magnetic susceptibility, relaxivity, gadolinium safety, feridex safety, application of contrast agent	Must Know	5
UNIT-3	Advancement in MRI Functional imaging in MRI Spectroscopy & its technique DTI Perfusion & its application	Must Know	10
UNIT-4	Special MRI Protocol MRCP, Urography MR guided biopsy Cardiac imaging MRI Breast Imaging	Must know	10
UNIT-5	MR angiography Cerebral Angiography Carotid Angiography Pulmomary Angiography Peripheral Angiography Abdominal Angiography Cardiac Angiography Chamber imaging	Must know	10

(For BRIT)

MRI Clinical Applications & Imaging Protocols

B. Sc. Semester V (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

1. Principles of magnetic resonance imaging, Instrumentation, basis of magnetic relaxation of T1W & T2W, Image contrast and noise, Inversion recovery pulse sequence, Rapid scan techniques, Fast spin-echo and echo-planar imaging, Fast and water signal separation methods.

2. Spectroscopy, Artifacts, Flow phenomena, Contrast agents, Interventional magneticresonance imaging, Bioeffects and safety,

3. MRI Breasts, liver, Adrenal gland, kidney, Urinary bladder, Knee, Shoulder, Brain, Salivary gland, Spine, Neck, CE Angiography, perfusion, Dynamic MRI, Spectroscopy, MRCP, Function MRI etc.

(BRIT)

Interventional in Diagnostic Radiology

B. Sc. Semester V (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**Introduction of Interventional Radiology** Definition	2
	Indication	2
	Clinical Application	2
	Advantages, disadvantages & risks	2
UNIT-2	**Name of different type of Procedures and description** All MRI Angiography	2
	All C.T. Angiography	2
	All Biopsy, FNAC, MRI Guided.	2
	All Biopsy, FNAC, USG Guided.	2
	All Biopsy, FNAC CT Scan Guided	2
	USG, CT Scan Guided Tapping	2
	Nerve Blocks.	2
	Radiofrequency Ablation	2

	Stereotactic Brain Biopsy	2
UNIT-3	DSA- Introduction & its various techniques like DSA chain, electronic subtraction, dual energy, k-edge, mask, hybrid, TID subtraction.	2
	Its application (vascular & nonvascular procedures)	2
	Instrumentation	2
	All DSA procedures	2
	Its advantages, disadvantages, Risks vs benefits ratio	2
	Patient's preparation for DSA procedures	2
UNIT-4	Role of artificial intelligence in interventional radiology & future aspect of AI	2

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2. Rad headline deleted part
3. Other colour shifted part

(For BRIT)

Interventional in Diagnostic Radiology

B. Sc. Semester V (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

1. Equipment construction & physics.
2.All angiography procedure & its technique
3. All biopsy & technique

(BRIT)

CT Clinical Applications & Imaging Protocols (Theory)

B. Sc. Semester V (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**NCCT** Brain, Face, Sinuses, Mastoid	Must Know	8
	Neck,		
	Abdomen, Pelvis,		
	Triple phase imaging, LAI		
	Extremities: Indications. Contraindications, Patient preparation, Protocols and patient care		
UNIT-2	**Contrast Enhanced Computed Tomography** Brain, Face, Sinuses, Mastoid	Must Know	10
	Neck,		
	Pituitary, IAC		
	Abdomen, Pelvis,		
	Extremities: Indications. Contraindications, Patient preparation, Protocols and patient care		
UNIT-3	Angiography & its technique Cerebral angiography carotid angiography Pulmonary angiography Abdominal angiography Renal angiography Peripheral angiography	Must Know	10
UNIT-4	Special Procedure its technique & reconstruction method Virtual CT-bronchoscopy, colonoscopy etc. CT Enterography, CT guided Biopsy procedures CT Urography CT Fluoroscopy	Must Know	10
UNIT-5	coronary angiography & its technique Calsium scoring, Cardiac gating, & its image reconstruction	Must Know	2

(For BRIT)

CT Clinical Applications & Imaging Protocols

B. Sc. Semester V (BRIT)

L	T	P	Credits		
-	-	2		**Examination:**	**30 Marks**
				Int. Assessment:	**20 Marks**
				Total:	**50 Marks**

PRACTICAL
CT Clinical Applications & Imaging Protocols

Application of various advanced procedures in well equipped Hospital and Diagnostic Centers:

1. All angiography procedures,
2. Liver triple phase
3. CT guided Biopsy
4. CT guided FNAC
5. Enterography

(BRIT)

Hospital Management & medical ethics (Theory)

B. Sc. Semester V (BRIT)

L	T	P	Credits		
3	1	-	4	**Examination:**	**60 Marks**
				Int. Assessment:	**40 Marks**
				Total:	**100 Marks**

Duration of Examination: 3 Hours

UNIT-1	**Introduction to hospital staffing-** Hospital staffing, administration, PACS, HIS, RIS, DICOM.	3
	Medical records and documentation- Medical records and documentation	3
UNIT-2	**Legal & medical issues'**Legal issues in radiology department, PNDT Act. Ethical issues in radiology, patient rights, patient responsibility, legal concerns, History taking, patient monitoring, inform consent, mal-practice, patient privacy issues.	3
	Professional ethics- Professional ethics and Code of conduct of radiographer	3
UNIT-3	**Handling of patients** Seriously ill and traumatized patients, visually impaired, hearing and speech impaired patients, mentally impaired patients/ psychologically issues, infectious patients, critical/trauma patients, pregnant patient, patient with implant. Handling of patient with life threading diseases like HIV, STD, HBsAG, etc.	4

UNIT-4	**Departmental Safety & Infection Control** Safety from hazards due to radiation (x-ray, gamma, radioisotopes, MRI, IV contrast media) electricity etc	3
	Infection control Skin care, donning of gowns, gloves, face masks, head caps, shoe covers	2
	Vitals signs- Vital signs. How to measure vital signs	2
	Body mechanics and transferring & shifting 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 Orthodox & Austrian method etc.	4
	First aid- Artificial respiration, hemostasis, first aid techniques, ABCD management	3
UNIT-5	**Anesthesia-** Local anesthesia and general anesthesia, uses in hospital, Facilities regarding general Anesthesia in the X-ray department. Adverse reactions- Management of adverse reactions to contrast media	4

(BRIT)

Research Methodology & Biostatistics

B. Sc. Semester V (BRIT)

L	T	P	Credits
3	1	-	4

Examination: 60 Marks
Int. Assessment: 40 Marks
Total: 100 Marks
Duration of Examination: 3 Hours

UNIT-1	**Introduction-** Definition and characteristics of statistics Importance of the study of statistics	2
	Branches of Statistics	2
	Statistics of and health sciences including nursing	2
	Parameters and estimates	2
	Descriptive and inferential statistics	2
	Variables and their types Measurement scales	
UNIT-2	**Tabulation of Data** Raw Data, the array, frequency distribution	2
	Basic principles of graphical representation	
	Types of diagrams – histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, normal probability curve	2

UNIT-3	**Measures of Central Tendency** Introduction: Uses, applications and practical approach	2
	Definition and calculation of mean for ungrouped and grouped data Meaning, interpretation and calculation of ungrouped and grouped data	2
	Meaning and calculation of mode	2
	Comparison of mean and mode	2
	Guidelines for the use of various measures of central tendency	2
UNIT-4	**Measures of Variability** Introduction: Uses, applications and practical approach	2
	The range, average deviation or mean deviation	2
	The variance and standard variation	2
	Calculation of Variance and standard variation for ungrouped and grouped data	2
	Properties and uses of variance and standard deviation	2
UNIT-5	**Sampling Techniques** Introduction: Uses, applications and practical approach Criteria for good samples	2
	Application of Sampling in Community	2
	Sampling Methods, Sampling and Non- Sampling errors Sampling variation and tests of significance	2