SCHEME & SYLLABUS

(Choice Based Credit System)

For

B.Sc.

In

Radiology and Imaging Technology

(w.e.f. Session 2022-2023)

Program Code: RIT-301

DEPARTMENT OF RADIOLOGY AND IMAGING TECHNOLOGY

RIMT UNIVERSITY, MANDIGOBINDGARH, PUNJAB

TABLE OF CONTENTS

SECTION 1

Vision & Mission of the University

VISION

To become one of the most preferred learning places a centre of excellence to promote and nurture future leaders who would facilitate in desired change in the society.

MISSION

- To impart teaching and learning through cutting edge technologies supported by the world class infrastructure.

- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values.

SECTION 2

Vision and Mission of the Department

VISION

The **Vision** of the Department of Radiology and Medical Imaging Technology is to be one of the best Departments in the healthcare system in providing timely, cost-efficient, and high quality Medical Imaging and image-guided therapy services for a diverse patient population. Our Department will also play a major and vital role in the education of patients, trainees, healthcare providers, healthcare administrators, legislators and payers, conveying the important and critical function that Medical Imaging and image-guided therapy serves in improving the outcomes and advancing the care of patients.

MISSION

- The **Mission** of the Department of Radiology and Medical Imaging at RIMT University is to provide compassionate, caring, and high quality Medical Imaging and image-guided therapy services to improve the quality of life for our patients and their families.

- Our leadership role in the scientific advancement of Medical Imaging and image-guided therapy services in a cost-efficient, less invasive and safe manner, while educating our referring physicians, physicians-in-training, medical students, allied health professionals, hospital administrators, legislators, and payers remains critical to our Mission

SECTION 3

About the Program

Bachelor of Radiology and Imaging Technology is an Under-Graduate medical imaging Program. Radiology Imaging Technology is a field of medical imaging that generally deals with the radiological procedures of the different modalities like X-Ray, Computed Tomography, Magnetic Resonance Imaging, and other interventional procedures.

Our B.Sc. Program is an Outcome Based Education model which is a 4 years, 8 Semester in which six semesters are of academic part and one semester i.e. 7^{th} and 8^{th} semester for clinical hospital practice. It is a full time Program of 133 credits with a Choice Based Credit System (CBCS) and Grading EvaluationSystem. B.Sc. Radiology and Imaging Technology program is structured semester wise and includes theory and practical to impart the students a holistic understanding of B.Sc. Radiology and Imaging Technology subjects.

SECTION 4

Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

PROGRAMME EDUCATION OBJECTIVES (PEOs)

PEO1	Establish their careers in the field of medical imaging and related areas like clinical application designing, providing innovative and effective solutions to image the patient with high skilled techniques.
PEO2	To provide students with a solid foundation in human body parts, their functioning, use and production of radiation and different imaging techniques.
PEO3	To train students with good clinical practice skills and imaging protocols so as to develop newer imaging techniques for different type of diseases.
PEO4	To provide students with an environment with modern imaging modalities and high skilled health professionals so that they will be handle patient in emergency situation comfortably.

PROGRAM OUTCOMES

PO 1	**Aims to have a vast knowledge of human body: -** Students gains the deep knowledge about the parts of human body, their function, their anatomical positions, structure and compositions.
PO 2	**Aims to know the working principle of the radiological equipment:** - Capability to identify the phenomena on which equipment work, aware about the production of the x - rays, teaches the role of the elements in the working, gives the knowledge about the use of radiological equipment in the diagnosis of the different diseases.
PO 3	**Aims to provide knowledge on radiation protection and dose measurement technique**: - Students gain the deep knowledge about protection of the patient and staff as well from the Harmful or unwanted radiations, to identify the risk, impact on health, dose limits for patient and staff, reading for the measurement of the dose, sign and symbols.
PO 4	**Effective Communication** – Students gain deep knowledge about the different radiological procedures and working of the body parts so that they can communicate with patient more effectively by elaborating the whole procedure so that patient will feel comfortable during the examinations.
PO 5	**Leadership and Team Work -** Ability to achieve quality to lead the team in right direction and guidance to the junior with extreme knowledge about all the modality and the procedures. And students are also trained for medical emergency situations so that they can deal more easily as a team during the critical hours
PO 6	**Global Orientation and Cross-Cultural Appreciation:** Ability to face any clinical issues from a global perspective with confidence, positivity like epidemic and exhibit an understanding of Cross-Cultural perspective of clinical and hospital management.
PO 7	**Entrepreneurship** –A strong business sense to explore entrepreneurial opportunities and leverage managerial & leadership skills for initiating, leading & managing startups like X-Ray, CT and MRI etc. as well as professionalizing and growing own diagnostic field.
PO 8	**Interventional Radiology and angiographic techniques:** – Students gain deep knowledge about the different interventional procedures, angiographic techniques and deep knowledge about the blood vessels.

PO 9	**Understand professional and ethical responsibility**: - Discover the all types of responsibility related to professional towards the patient, medical ethical Values, role of a professional, clinical responsibility, problem solving attitude, work efficiency, Relation between professional and patient and with the fellow colleague.
PO 10	**Life Long Learning** – Aptitude to acquire newer knowledge and skills, assimilate and adapt them to be ready to confront uncharted environment scientifically and confidently.
PO 11	**Sound Decision making**- Use of appropriate technologies in gathering and analyzing data relevant to decision-making for patient's reports and prescription of treatment to the patient.
PO 12	**Effective Opportunity Identification** - Evaluate clinical environment and opportunities and devise strategies for responding effectively to problems, threats, and opportunities

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Demonstrate practical aim of different instruments like ionization chambers, focal spot measurements, kVp measurement, radiation dosimeters, phantoms, cassettes, screens and lead shields etc. And handling of the radiological equipments.
PSO 2	Demonstrate knowledge on various radiological positioning and techniques for different type of examinations in different modalities like X-Ray, Computed Tomography, X-ray, fluoroscopy, MRI and other medical imaging techniques.
PSO 3:	Describe modern imaging technologies for different type of the diseases and impact of the same on the healthcare system.

SECTION 5

Curriculum / Scheme with Examination Grading Scheme

INDUCTION PROGRAM

Induction Program (Mandatory)	
Duration	4 Years
Frequency	Induction program for students to be offered right at the start of the first year
Activities	Physical Activity. Sports, Yoga & Stress Management. Creative Arts and carrier programme. Universal Human Values and medical ethics. Lectures by Eminent People of healthcare. Visits to different hospitals for clinical exposures. Familiarization to Dept./Branch & Innovations

Semester Wise Summary of the program

S.no.	Semester	No. of Contact Hours	Marks	Credits
1.	I	21	800	21
2.	II	24	700	24
3.	III	24	600	24
4.	IV	20	600	20
5.	V	24	600	24
6.	VI	20	500	20
7.	VII & VIII	***(INTERNSHIP)***		
	Total	133	3800	133

Study scheme for BSc. RIT (22-23)

B.Sc. RIT 1 semester

		Contact Hours/Week				Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P	Credits	MTE	ETE	Total	
BRAD-1101	Human anatomy & physiology	4	--	--	04	40	60	100	3 Hrs.
BRAD-1102	Radiological Terminology	3	--	--	03	40	60	100	3 Hrs.
BRAD-1103	Medical ethics	2	--	--	02	40	60	100	3 Hrs.
BRAD-1104	Radiation Physics	3	--	--	03	40	60	100	3 Hrs.
BRAD-1105	Communication skills	3	--	--	03	40	60	100	3 Hrs.
BRAD-1171	Human anatomy and physiology (practical)			2	02	40	60	100	3 Hrs.
BRAD-1172	Radiation Physics (practical)			2	02	40	60	100	3 Hrs.
BRAD-1173	Communication skills (practical)			2	02	40	60	100	3 Hrs.
Total		15	--	06	21	320	480	800	

B.Sc. RIT 2rd Semester:

Subject		Contact Hours/week				Evaluation Scheme (% of Total Marks)			Exam Duration (hours)
Code	Title	L	T	P	Credits	MTE	ETE	Total	
BRAD-1201	Radiation physics	05	--	--	05	40	60	100	3 Hrs.
BRAD-1202	Radiographic positioning and techniques	04	--	--	04	40	60	100	3 Hrs.
BRAD-1203	Human anatomy & physiology	04	--	--	04	40	60	100	3 Hrs.
BRAD-1204	Biochemistry	03	--	--	03	40	60	100	3 Hrs.
BRAD-1205	Basic Pathology and Biomedical waste Management	4			4	40	60	100	3 Hrs.
BRAD-1271	Radiographic positioning and techniques (practical)			02	02	40	60	100	3 Hrs.
BRAD-1272	Human anatomy &physiology (practical)			02	02	40	60	100	3 Hrs.
Total		20		04	24	280	420	700	

B.sc RIT 3rd Semester:

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P		MTE	ETE	Total	
BRAD-2301	Radiographic Equipmentation	05	--	--	05	40	60	100	3 Hrs.
BRAD-2302	Dark Room Techniques	05	--	--	05	40	60	100	3 Hrs.
BRAD-2303	Radiographic procedure-I	05	--	--	05	40	60	100	3 Hrs.
BRAD-2304	Radiographic procedure-II	05	--	--	05	40	60	100	3 Hrs.
BRAD-2305	Dark Room Techniques (Practical)		--	02	02	40	60	100	3 Hrs.
BRAD-2371	Radiographic procedures I & II (Practical)			02	02	40	60	100	3 Hrs.
	Total	20		04	24	240	360	600	

B.sc RIT 4th Semester

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P		MTE	ETE	Total	
	Program elective	04	--	--	04	40	60	100	3 Hrs.
BRAD-2402	Radiation hazards, control and safety	04	--	--	04	40	60	100	3 Hrs.
BRAD-2403	Computed tomography	04	--	--	04	40	60	100	3 Hrs.
BRAD-2404	Quality assurance in diagnostic radiology	04	--	--	04	40	60	100	3 Hrs.
BRAD-2405	Patient care in diagnostic radiology (practical)			02	02	40	60	100	3 Hrs.
BRAD-2471	Computed tomography (practical)			02	02	40	60	100	3 Hrs.
Total		16		04	20	240	360	600	

	COURSE CODE	COURSE TITLE
PROGRAM ELECTIVE – 1	**BRAD-2401**	PATIENT CARE IN DIAGNOSTIC RADIOLOGY
	BRAD-2406	HEALTH CARE MANAGEMENT

B.Sc. RIT 5thSemester

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P		MTE	ETE	Total	
BRAD-3501	Ultrasonography and mammography	05	--	--	05	40	60	100	3 Hrs.
BRAD-3502	Radiological procedure	05	--	--	05	40	60	100	3 Hrs.
BRAD-3503	Interventional radiology	05	--	--	05	40	60	100	3 Hrs.
BRAD-3504	Magnetic resonance imaging	05			05	40	60	100	3 Hrs.
BRAD-3571	Radiological procedure (practical)			02	02	40	60	100	3 Hrs.
BRAD-3572	Interventional radiology (practical)			02	02	40	60	100	3 Hrs.
Total		20		04	24	240	360	600	

B.Sc. RIT 6thSemester

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P		MTE	ETE	Total	
BRAD-3601	Magnetic resonance imaging	05		--	05	40	60	100	3 Hrs.
	Program elective	05		--	05	40	60	100	3 Hrs.
BRAD-3603	Nuclear imaging techniques	05		--	05	40	60	100	3 Hrs.
BRAD-3604	Biostatistics and Research methodology	03			03	40	60	100	3 Hrs.
BRAD-3671	Magnetic resonance imaging (practical)			02	02	40	60	100	3 Hrs.
Total		18		02	20	200	300	500	

	COURSE CODE	COURSE TITLE
PROGRAM ELECTIVE	**BRAD- 3602**	RECENT ADVANCEMENT IN RADIOLOGY
	BRAD-3605	GENERAL MICROBIOLOGY

SUBJECT TITLE –HUMAN ANATOMY AND PHYSIOLGY
SUBJECT CODE: BRAD-1101
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

Course objectives: This subject is designed to impart fundamental knowledge about the human body as a whole, anatomy of the circulatory system, nervous system, the skeletal system. Types of bone, structures and growth of bones. Divisions of the skeleton, appendicular skeleton, axial skeleton. General physiology of cell, blood, gastrointestinal tract: structure and function.

Sr.No	CONTENTS	HOURS
UNIT-I	**THE HUMAN BODY AS A WHOLE:** • Sub divisions of anatomy • Terms of location and position • Fundamental planes • Vertebrate structure of man • Organization of the body cells and tissue	6
UNIT-II	**Locomotion and support:** • Types of bones • Structure and growth of bones • Divisions of the skeleton • Bones of upper limb • Bones of lower limb • Joint classification • Types of movements with example	8
UNIT-III	**Anatomy of the nervous system:** • Spinal cord anatomy and functions • Reflex arc6 • The brain- hind brain, mid brain, forebrain	6

	• Cerebrum, cerebellum • Brain stem- brief structure, location, functions • Peripheral nervous system	
UNIT-IV	**Anatomy of circulatory system:** • Heart size, location, coverings • Chamber and valves of heart • Blood supply, nerve supply • General plan of circulations • Pulmonary circulation • Major arteries and veins	6

PHYSIOLOGY:

Sr.No	CONTENTS	HOURS
UNIT-I	**GENERAL PHYSIOLOGY-CELL:** • Structure and function of cell • Transport across the cell membrane • Active and passive transport, diffusion and osmosis • Distribution and ionic composition of body fluids • The membrane potential	8
UNIT-II	**BLOOD:** • Composition and functions of blood • Types of blood cells • Coagulation of blood • Clotting factors • Blood groups • Immunity	8
UNIT-III	**GASTROINTESTINAL TRACT:** • Composition and functions of saliva • Stomach- structure and function • Pancreas- structure and function • Liver- structure and function • Intestine, gall bladder • Balanced diet	8
UNIT-IV	**RESPIRATORY SYSTEM:** • Structure and function of respiratory system	6

	• Mechanism of respiration • Lung volume and capacities • Regulation of respiration	
UNIT-V	**CARDIOVASCULAR SYSTEM:** • Structure and function • Properties of cardiac muscle • Regulation of cardio-vascular system	6

Course Outcomes:

BRAD 1101.1	This subject is designed to impart fundamental knowledge about the human body as a whole.
BRAD 1101.2	This subject is designed to study skeletal system, bones, joints, circulatory system, nervous system
BRAD 1101.3	Demonstrate knowledge on general physiology of cell, blood Gastrointestinal Tract Structure and Functions Oral Cavity, ingestion, digestion, absorption respiratory system.
BRAD 1101.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Books:

- **Principles of Anatomy &Physiology by Tortora & Bryan.**
- **Ross & Wilson Anatomy & physiology.**

SUBJECTTITLE: RADIOLOGICAL TERMINOLOGY

SUBJECTCODE: BRAD-1102

SEMESTER: I

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
3		-	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam: 3Hrs

Course objectives: this course is designed to study about the anatomical positions, radiology and medical imaging, body position and movement, different body projections.

Sr.No	CONTENTS	HOURS
UNIT-I	**RADIOLOGY AND MEDICAL IMAGING:** • DIAGNOSTIC RADIOLOGY • INTERVENTIONAL RADIOLOGY • X-RAY • CT • MRI • NUCLEAR MEDICINE	15
UNIT-II	**ANATOMICAL POSITIONING:** • Body planes • Sagittal, coronal • Horizontal, oblique plane	8
UNIT-III	**BODY MOVEMENTS:** • Flexion , extension, abduction, adduction, pronation, supination	5
UNIT-IV	**PROJECTION:** • Anterior, Posterior, Anterior-posterior, Lateral, Oblique, Fowler's Position,-Trandelenous bury position/ Sin's position, Torso & head, Extremities	8

COURSE OUTCOMES:

BRAD 1102.1	This subject is designed to impart fundamental knowledge about the Radiographic positioning for upper limbs like Hand, fingers, thumb, scaphoid. The shoulder- Radiographic Positioning, Glenohumeral joint, Calcified tendons, Acromion-clavicular joint.
BRAD 1102.2	This subject is designed to study about The Lower Limb foot,, toes ankle joint calcaneum, subtalar joint, tibia fibula, knee joint
BRAD 1102.3	Demonstrate knowledge on The Hip, Pelvis, And Sacro-Iliac Joints, The vertebral column.
BRAD 1102.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

SUBJECTTITLE: MEDICAL ETHICS
SUBJECT CODE: BRAD-1103
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
2	-	-	2

Internal Assessment: 40

End Term Exam: 60

Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course is designed to study about ethics classification, ethical theory, ethical value, ethical decision making.

Sr.No	CONTENTS	HOURS
UNIT-I	**DECISION MAKING:** • Definition, goal and scope • Morals of medical ethics	6
UNIT-II	**CODE OF CONDUCT:** • DEFINITION • INTRODUCTION	6
UNIT-III	**BASIC PRINCIPLES OF MEDICAL ETHICS:** • Confidentiality	3
UNIT-IV	**MALPRACTICE AND NEGLIGENCE:** • rational and irrational drug therapy	3
UNIT-V	• Autonomy and informed consent • Rights of patients	4
UNIT-VI	• Care of the terminally ill euthanasia	2
UNIT-VII	• Medico-legal aspects of medical records • Medico legal case and type of cases Records and documents related to MLC • Ownership of medical records Confidentiality Privilege-communication	5

COURSE OUTCOMES:

BRAD 1103.1	This subject is designed to impart fundamental knowledge about Values Classification, Personal, Professional and Organization
BRAD 1103.2	This subject is designed to study about Ethical Concept: Autonomy, Beneficence, non-male Faience, Veracity, Fidelity, Informed consent, Ethical Decision Making
BRAD 1103.3	Demonstrate knowledge on Ethical theory; Classic- Deontology, Teleology, Contemporary-Ethic of care, Feminist ethics, Justice ethics, Value ethics
BRAD 1103.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

SUBJECT TITLE: RADIATION PHYSICS
SUBJECTCODE: BRAD-1104
SEMESTER: I
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
3	-		3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course will prepare the young technologist to study about basic CT, MRI, radiation units, and basic concept of electromagnetic radiation.

Sr.No	Contents	HOURS
UNIT-I	**BASIC CONCEPTS OF ELECTRO - MAGNETIC RADIATION:** • Structure of atom • Basic concepts of electricity &magnetism • current voltage • electro-magnetic induction radioactivity	8
UNIT-II	**X–Ray**: • Discovery of x-rays, properties • Production, x-ray • Spectrum, bremsstrahlung and characteristic x-rays • Interaction, ionization, excitation, attenuation • Coolidge tube design, line focus principle	8

UNIT-III	**RADIATION UNIT:** • Exposure, Coulombs/kg, • Air Karma-gray • Absorbed dose-gray • Equivalent dose	8
UNIT-IV	**X-RAY CIRCUIT**: • Transformer • Rectification, • Fuses and switch, generators	8
UNIT V	• History of CT, MRI and USG • Introduction to CT, MRI and USG	8

COURSE OUTCOMES:

BRAD 1104.1	This subject is designed to study about the Radiation Protection: principal history &development, National& international agencies AERB BARC ICRP WHO IAEA Sources of radiation natural man made & internal exposures.
BRAD 1104.2	This subject is designed to study Basic concepts of effect on cell stochastic & deterministic effects, Radiation risk tissues at risk genetic somatic & fetus risk at other industries. Dose equivalent limits philosophy ICRP (60) concepts-AERB guidelines
BRAD 1104.3	Demonstrate knowledge on planning of radiation installation protection Primary Radiation and scattered radiation.
BRAD 1104.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Books:

- **RADIOLOGY FOR RESIDENTS AND TECHNICIANS BY DR.S.K.BHARGAVA**.
- **THE PHYSICS OF RADIOLOGY AND IMAGING BY K.THAYALAN**

SUBJECT TITLE: COMMUNICATION SKILL
SUBJECTCODE: BRAD-1105
SEMESTER: I
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
3	-		3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course is designed to help the students acquire a good command and comprehension of the English language through individual papers and conferences.

Sr.No	Contents	HOURS
UNIT-I	**PARTS OF SPEECH:** • Definition of all the sight parts along with examples and their use in language • Articles: Definite and indefinite Articles • Definition and its uses along with examples and personal, Reflexive, Emphatic, Demonstrative, Relative, indefinite, • sentences: Active and Passive Voice, Mood and Narration	15
UNIT-II	**WORDS AND PHRASES:** Word Formation (Prefix, Suffix),Idioms, Synonyms, and Antonyms • Phonetics: Speech Sound, the phoneme, the syllable, and transcription	8
UNIT-III	**APPLIEDGRAMMAR:** • Correct usage, the structure of sentences, and the structure of paragraphs enlargements of Vocabulary.	8
UNIT-IV	• Precise writing and summarizing Writing of bibliography	6

COURSE OUTCOMES:

BRAD 1105.1	This subject is designed to impart fundamental knowledge about the Parts of Speech (Definition of all the sight parts along with examples and their use in language) Articles: Definite and indefinite Articles (a. an and the) Definition and its uses along with examples and personal, Reflexive, Emphatic, Demonstrative, Relative, indefinite, Interrogative and distributive pronouns
BRAD 1105.2	This subject is designed to study The Noun (Defining Noun along with types and categories): Gender; Number Case, The Adjective: Comparison, adjective used as nouns, positions of the adjective and its correct use of adjectives. The Verb Definition. Its forms, Verbs of Incomplete Predication.
BRAD 1105.3	Demonstrate knowledge on The Sentence and its types, Simple, Compound and Complex, Subject and Predicate (Parts of a sentence), Transformation of sentences: Active and Passive Voice, Mood and Narration (Direct and indirect Speeches)
BRAD 1105.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

SUBJECT TITLE: HUMAN ANATOMY AND PHYSIOLOGY (PRACTICALS)

SUBJECT CODE: BRAD-1171

CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
-	-	2	2

Internal Assessment: 40

End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

The main aim of this course is bone identification and side determination upper limb- clavicle, scapula, humerus, radius, ulna. Lower limb-femur, hipbone, tibia, fibula and vertebral column, Ribs, sternum and sacrum. Demonstration of heart and collection of blood. Determination of blood groups.

Sr.No	Contents	HOURS
SECTION-I	**ANATOMY PRACTICAL:** • Demonstration of bones identification and side determination • Upper-limb-clavicle, scapula, humerus, radius ,ulna, lower limb-Femur, Hipbone, Tibia, Fibula, Vertebral Column, Ribs, Sternum, Sacrum, Demonstration of heart.	15
SECTION-II	**PHYSIOLOGYPRACTICAL:** • Collection of blood • Study of hemocytometer • Hemoglobinometry white blood cell count, red blood cell count • Determination of blood groups • Leishman's staining and differentiate WBC counts. • Determination of packed cell value • Calculation of blood indices, fragility test for R.B.C	15

Course Objectives

BRAD 1171.1	This subject is designed to impart fundamental knowledge about blood, structure and Collection of blood.
BRAD 1171.2	This subject is designed to study about Study of hemocytometer. Hemoglobinometry white blood cell count, red blood cell count,
BRAD 1171.3	Demonstrate knowledge on Leishman's staining and differentiate WBC counts, Determination of blood groups
BRAD 1171.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

SUBJECT TITLE: RADIATION PHYSICS- PRACTICAL
SUBJECTCODE: BRAD -1172
SEMESTER: I
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
	-	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

Sr.No	Contents	HOURS
SECTION-I	**Practical concerns with radiation physics** ➢ Practical knowledge of x-ray tube, anode, cathode, rotor, filter, generators, ➢ Control panel switches and functions. ➢ Cones. ➢ All the above-mentioned topics in radiation physics	20

BRAD1172.1	This subject is designed to impart fundamental knowledge about Practical knowledge of x-ray tube, anode, cathode, rotor, filter, generators
BRAD 1172.2	This subject is designed to study Basic concepts of electromagnetic radiation, occupational exposure of pregnant women, Control panel switches and functions
BRAD 1172.3	Demonstrate knowledge on Basics CT & MRI, introduction to CT/MRI, principle of MRI, coils, cones
BRAD 1172.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **RADIOLOGY FOR RESIDENTS AND TECHNICIANS BY DR.S.K.BHARGAVA**.

SUBJECTTITLE: COMMUNICATION SKILLS (PRACTICAL)
SUBJECT CODE: BRAD - 1173
SEMESTER: I
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
-	-		2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

Sr.No	Contents	
UNIT-I	PartsofSpeech(Definitionofallthesightpartsalongwithexamplesandtheiruseinlanguage)Articles:Definite and indefinite Articles (a. an and the) Definition and its uses along with examples and personal, Reflexive, Emphatic, Demonstrative, Relative, indefinite, Interrogative and distributive pronouns	15
UNIT-II	APPLIEDGRAMMAR**:** Correct usage the structure of sentences.	5
UNIT-III	Words and Phrases: Word Formation (Prefix, Suffix) Idioms, Synonyms and Antonyms Phonetics: Speech Sound, the phoneme, the syllable and IPA transcription.	10

SUBJECT TITLE: RADIATION PHYSICS
SUBJECT CODE: BRAD-1201
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-	-	5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

Sr. No	Contents	HOURS
UNIT-I	**RADIATION PROTECTION:** • Principle history & development– • National & international agencies AERB BARC ICRP WHO IAEA • Sources of radiation natural man made & internal exposures.	15
UNIT-II	**BIOLOGICAL EFFECTS OF RADIATION:** • Effect on cell stochastic &deterministic effects • Radiation risk tissues at risk genetic somatic & fetus risk at other industries. • Dose equivalent limits philosophy ICRP (60) concepts-AERB guidelines. .	20
UNIT-III	**PLANNING OF RADIATION INSTALLATION PROTECTION:** • Primary Radiation and scattered radiation. • Barrier design. Primary & secondary barrier design. • Control of radiation-effect of time distance and shielding.	20

COURSE OUTCOMES:

BRAD1201.1	This subject is designed to study about the Radiation Protection: principal history & development, National & international agencies AERB BARC ICRP WHO IAEA Sources of radiation natural man-made & internal exposures.
BRAD 1201.2	This subject is designed to study Basic concepts of effect on cell stochastic & deterministic effects, Radiation risk tissues at risk genetic somatic & fetus risk at other industries. Dose equivalent limit's philosophy ICRP (60) concepts-AERB guidelines
BRAD 1201.3	Demonstrate knowledge on planning of radiation installation protection Primary Radiation and scattered radiation.
BRAD1201.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **RADIOLOGY FOR RESIDENTS AND TECHNICIANS BY DR.S.K.BHARGAVA**.

SUBJECTTITLE: RADIOGRAPHIC POSITIONING AND TECHNIQUES
SUBJECT CODE: BRAD-1202
SEMESTER: II
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
4	-		4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

The main aim of this course is to help the students know about the basic positioning and procedures of upper limb, lower limb, Hip, Pelvis, And Sacro-Iliac Joints, vertebral column, radiological projections of abdomen.

Sr.No	Contents	HOURS
UNIT-I	**RADIOGRAPHIC POSITIONING FOR UPPER LIMBS:** • Hand • fingers • thumb • scaphoid • wrist • forearm • elbow Humerus	15
UNIT-II	**THE SHOULDER-RADIOGRAPHIC POSITIONING:** • Glenohumeral joint • Calcified tendons, • Acromio-clavicular joint • clavicle • Sterno-clavicular joint • scapula • scapula • coracoids process	10
UNIT-III	**The Lower Limb:** • foot • toes • ankle joint • calcaneum	10

	• subtalar joint	
UNIT-IV	**The Hip, Pelvis and Sacro-Iliac Joints:** • anatomy and image appearance • effect of rotation • hip joint • acetabulum • pelvis • Sacro-Iliac Joint	15

Course Outcomes:

BRAD 1202.1	This subject is designed to impart fundamental knowledge about the Radiographic positioning for upper limbs like Hand, fingers, thumb, scaphoid. The shoulder-Radiographic Positioning, Glenohumeral joint, Calcified tendons, Acromion-clavicular joint.
BRAD 1202.2	This subject is designed to study about The Lower Limb foot,, toes ankle joint calcaneum, subtalar joint, tibia fibula, knee joint
BRAD 1202.3	Demonstrate knowledge on The Hip, Pelvis, And Sacro-Iliac Joints, The vertebral column
BRAD 1202.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

SUBJECT TITLE: HUMAN ANATOMY AND PHYSIOLOGY

SUBJECT CODE: BRAD- 1203

SEMESTER: II

CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
4	-	-	4

OBJECTIVE AND OUT COME OF COURSE:

This study focuses on the basic about the anatomy of different human body systems like respiratory system, digestive system, excretory system, reproductive system.

Sr.No	Contents	Hours
UNIT-I	**ANATOMY OF THE RESPIRATORY SYSTEM:** • Organs of Respiratory System, Conducting portion, • Nasal cavity, Para nasal air sinuses, Larynx, trachea, bronchial tree. • Pleurae and lungs, Brief knowledge of parts and position.	10
UNIT-II	**ANATOMY OF THE DIGESTIVE SYSTEM:** • Components of Digestive system, alimentary tube • Anatomy of organs of digestive tube, mouth ,salivary glands, stomach ,intestine, liver, • Names and positions and brief functions,	15
UNIT-III	**ANATOMY OF EXCRETORY SYSTEM AND REPRODUCTIVE SYSTEM:** • location, gross structure & function structure of nephron, excretory ducts, • Urinary bladder, Urethra gross structure & function. • Male Reproductive System: Testis, Duct system. Female Reproductive System:	10

UNIT-IV	**ANATOMY OF THE ENDOCRINE SYSTEM:** • Name of all endocrine glands their positions, Hormones and their functions • Thyroid, parathyroid, Adrenal glands, Gonads &Islets of pancreas.	15

BRAD1203.1	This subject is designed to impart fundamental knowledge about anatomy of the respiratory system: Organs of Respiratory System, Conducting portion, Nose: nasal cavity.
BRAD1203.2	This subject is designed to study about The Anatomy of the digestive system: Components of Digestive system, alimentary tube, Anatomy of organs of digestive tube, mouth, salivary glands, stomach, intestine, liver, biliary apparatus, pancreas, Names and positions and brief functions.
BRAD1203.3	Demonstrate knowledge on Anatomy of excretory system and reproductive system. Kidneys: location, gross structure & function structure of nephron, excretory ducts, ureters, Urinary bladder, Urethra gross structure & function. Male Reproductive System: Testis, Duct system. Female Reproductive System.
BRAD 1203.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Program Name: B.Sc. Radiology and Imaging Technology
Programme Code: RIT-301

SUBJECT TITLE: BIOCHEMISTRY

SUBJECTCODE: BRAD-1204

SEMESTER: II

CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
3	-	-	3

Internal Assessment:
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course is designed to help the students to understand about the basics of cell, chemistry of proteins, carbohydrates, lipids, enzymes, vitamins.

Contents of Syllabus:

Sr.No	Contents	HOURS
UNIT-I	**CELL**: • Definitions, types, cell organelles, plasma membrane, fluid mosaic model.	10
UNIT-II	**CHEMISTRYOFCARBOHYDRATES:** • Definition, Classification, Structural Isomerism • Glycolysis, gluconeogenesis.	7
UNIT-III	**CHEMISTRY OF PROTEINS AND AMINO ACIDS:** • Definition, Structure and classification of Amino Acids • Functional classification of proteins.	10
UNIT-IV	**CHEMISTRY OF LIPIDS:** • Definition of lipids • Classification of lipids • Sources,Phospholipids,Gangliosides,Cerebrosides,Glycolipids,Lipoproteins(definition,classificationandfunctions)ChemicalreactionsofLipids,ketonebodies and beta-oxidation.	15

Course Outcomes:-

BRAD 1204.1	This subject is designed to impart fundamental knowledge about the Cell: definitions, types, cell organelles, plasma membrane, fluid mosaic model, Chemistry of Carbohydrates: Definition, Classification, Structural Isomerism, glycolysis, gluconeogenesis.
BRAD 1204.2	This subject is designed to study about The Chemistry of Proteins and Amino Acids: Definition, Structure and classification of Amino Acids, Functional classification of proteins. Enzymes: definition, classification, importance and functions of enzymes
BRAD 1204.3	Demonstrate knowledge on The Chemistry of Lipids: Definition of lipids, Classification of lipids, Sources, Phospholipids, Gangliosides, Cerebrosides, Glycolipids, Lipoproteins (definition, classification and functions) Chemical reactions of Lipids, ketone bodies and beta oxidation.
BRAD 1204.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Program Name: B.Sc. Radiology and Imaging Technology
Programme Code: RIT-301

SUBJECT TITLE: BASIC PATHOLOGY AND BIOMEDICAL WASTE MANAGEMENT

SUBJECTCODE: BRAD-1205

SEMESTER: II

CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
4	-	-	4

Internal Assessment:
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course is designed to help the students to understand about the mechanism of injury to cells and tissues and about the different waste and how it's been segregated with it's transportation and it's disposal.

Contents of Syllabus:

Sr.No	Contents	HOURS
UNIT-I	**INTRODUCTION TO PATHOLOGY/GENERAL PATHOLOGY:** 1.1 Different sections in pathology 1.2 The Cell in health 1.3 Normal cell structure 1.4 Cell Injury and Cell death • Causes and mechanism of cell injury S • Reversible and irreversible cell injury	**8**
UNIT-II	**CARDIOVASCULAR PATHOLOGY:** 2.1 Coronary Atherosclerosis: definition, risk factors, clinical significance and prevention. 2.2 Cardiomyopathy: definition, types, causes and significance 2.3 Stroke 2.4 Aortic disease 2.5 Hypertension: definition, types and effects of hypertension. 2.6 Aneurysms: definition, classification, pathology and complications.	**8**
UNIT-III	**RESPIRATORY PATHOLOGY:** ○ Pleural effusion: causes, effects and diagnosis. ○ Pneumothorax ○ Pulmonary hypertension	**8**

	○ Tuberculosis. ○ Lung cancer. ○ Lung infection (pneumonia) ○ Abnormal build-up of fluid in the lungs (pulmonary edema) •	
UNIT-IV	**HEMATOLOGY:** Anemia: definition, morphological types and diagnosis of anemia. 4.2 Leukocyte disorders: leukemia, leukocytosis, agranulocytosis. 4.3 Bleeding disorders: definition, classification, causes & effects of important types of bleeding disorders.	**8**
UNIT-V	**HOSPITAL WASTE MANAGEMENT:** 5.1 Introduction and principle of hospital waste management 5.2 Guidelines by WHO for safe health care waste management 5.3 Colour coding in medical waste management 5.4 Rules of disposal of medical waste	**9**
UNIT-VI	**CLASSIFICATION FOR MEDICAL WASTE:** 6.1 Infectious waste 6.2 Hazardous waste 6.3 Radioactive waste 6.4 General waste	**8**
UNIT-VII	**HEALTH IMPACTS OF BIOCHEMICAL'S WASTE AND IT'S MANAGEMENT:** 7.1 Basic information about infection 7.2 Direct & indirect hazards. 7.3 Potential health hazards. 7.4 Collection and handling of waste	**10**

Course Outcomes:-

BRAD 1205.1	Demonstrate an understanding of essential basic pathology processes including cell death and injury, inflammation, thrombosis and neoplasia.
BRAD 1205.2	Acquire the ability to relate these essential basic pathological processes to the pathogenesis of common and important disease.
BRAD 1205.3	Enhance understanding of biomedical waste management.
BRAD 1205.4	Enhance understanding of infection in hospitals.

SUBJECT TITLE: RADIOGRAPHIC POSITIONING AND TECHNIQUES-PRACTICAL

SUBJECTCODE: BRAD-1271

SEMESTER: II

CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
-	-	2	2

Internal Assessment:

End Term Exam: 60

Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This study helps the students to understand the basic positioning of different body parts during a radiographic procedure, positioning, rotation, technical factors during procedures.

Sr.No	Contents	HOURS
UNIT-I	**RADIOGRAPHIC POSITIONING FOR UPPER LIMBS:** • Hand • fingers • thumb • scaphoid • wrist • forearm • elbow • Humerus	**10**
UNIT-II	**THE SHOULDER-** • Calcified tendons, • Acromio-clavicular joint • clavicle • sterno clavicular joint • scapula • scapula • coracoids process	**10**
UNIT-III	**The Lower Limb:** • foot • toes • ankle joint • calcaneum • subtalar joint	**5**

UNIT-IV	**THE HIP, PELVIS, AND SACRO-ILIAC JOINTS:** • anatomy and image appearance • effect of rotation • hip joint • acetabulum • pelvis • Sacro-Iliac Joint	**5**

Course Outcomes

BRAD 1271.1	This subject is designed to impart fundamental knowledge about the Radiographic positioning for upper limbs like Hand, fingers, thumb, scaphoid. The shoulder- Radiographic Positioning, Glenohumeral joint, Calcified tendons, Acromion-clavicular joint.
BRAD 1271.2	This subject is designed to study about The Lower Limb foot, toes ankle joint calcaneum, subtalar joint, tibia fibula, knee joint
BRAD 1271.3	Demonstrate knowledge on The Hip, Pelvis, And Sacro-Iliac Joints, The vertebral column
BRAD 1271.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOK:

- **Clark's Positioning in Radiograph**

SUBJECTTITLE: HUMAN ANATOMY & PHYSIOLOGY-PRACTICAL
SUBJECT CODE: BRAD-1272
SEMESTER: II
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
	-	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVE:

This study focuses on the basic about the anatomy of different human body systems like respiratory system, digestive system, excretory system, reproductive system.

Sr.No	Contents	HOURS
UNIT-I	**ANATOMY OF THE RESPIRATORY SYSTEM:** • Organs of Respiratory System, Conducting portion, • Nose**:** nasal cavity, Para nasal air sinuses, Larynx, trachea, bronchial tree. • Respiratory portion**:** Pleurae and lungs, Brief knowledge of parts and position.	8
UNIT-II	**ANATOMY OF THE DIGESTIVE SYSTEM:** • Components of Digestive system, alimentary tube, • Anatomy of organs of digestive tube, mouth, salivary glands, stomach, intestine, liver, • Biliary apparatus, pancreas, • Names and positions and brief functions,	8
UNIT-III	**ANATOMY OF EXCRETORY SYSTEM AND REPRODUCTIVE SYSTEM.** • **Kidneys:** location, gross structure& function structure • Urinary bladder, Urethra gross structure & function. Male Reproductive System: Testis, Duct system. Female Reproductive System:	6
UNIT-IV	**ANATOMY OF THE ENDOCRINE SYSTEM:** • Name of all endocrine glands their positions, Hormones and their functions • Pituitary, Thyroid, parathyroid, Adrenal glands, Gonads & Islets of pancreas.	6

COURSE OUTCOMES:

BRAD1272.1	This subject is designed to impart fundamental knowledge about anatomy of the respiratory system: Organs of Respiratory System, Conducting portion, Nose: nasal cavity.
BRAD1272.2	This subject is designed to study about The Anatomy of the digestive system: Components of Digestive system, alimentary tube, Anatomy of organs of digestive tube, mouth, salivary glands, stomach, intestine, liver, biliary apparatus, pancreas, Names and positions and brief functions.
BRAD1272.3	Demonstrate knowledge on Anatomy of excretory system and reproductive system. Kidneys: location, gross structure & function structure of nephron, excretory ducts, ureters, Urinary bladder, Urethra gross structure & function. Male Reproductive System: Testis, Duct system. Female Reproductive System.
BRAD 1272.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **Ross and Wilson anatomy and physiology**

SUBJECT TITLE: RADIOGRAPHIC EQUIPMENTATION
SUBJECT CODE: BRAD- 2301
SEMESTER: III
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-	-	5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVE:

This subject is designed to impart fundamental knowledge about the history of x-ray tubes, mammography, computed tomography, MRI and other radiologic equipments.

Sr.No	Contents	HOURS
UNIT-I	**THE X-RAY TUBE:** • History of x-ray tube • Components of the X-ray-tube • Types of x-ray tube • Operating console of an X-RAY tube • The current through the X-ray tube and the exposure time, • high-voltage generator	15
UNIT-II	**FLUOROSCOPY:** • history of it • application • types of Fluoroscopy machine • advantages and disadvantages	15
UNIT-III	**PORTABLE/MOBILE X-RAY UNITS:** • invention of portable machine • construction • application • advantages and disadvantages	10
UNIT-IV	**MAMMOGRAPHY:** • Introduction • X-ray tube construction.	10

Course Outcomes:

BRAD 2301.1	This subject is designed to study about the history of x ray tube, components of the x-ray tube, types of x ray tube, operating console of an x-ray tube, the current through the x-ray tube and the exposure time and high- voltage generator.
BRAD 2301.2	The study focuses on the construction application, advantages and disadvantages, x ray tube construction. Application and common views in radiography.
BRAD 2301.3	The study deals with the history of CT, principle of CT machine and parts of CT machine.
BRAD 2301.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended book:

- **RADIOLOGICAL EQUIPMENTS (English, Paperback, Kvp. Murugan)**

SUBJECT TITLE: DARK ROOM TECHNIQUE
SUBJECTCODE: BRAD- 2302
SEMESTER: II
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-		5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVE:

This course deals with the fundamentals of manual processing, automatic processing, darkroom structure, fixer and its chemistry, care of intensifying screen.

Sr.No	Contents	HOURS
UNIT-I	**DARK ROOM:** • Definition. • Construction of darkroom. • Equipment presents in darkroom.	10
UNIT-II	**X-RAY CASSETTES:** • Definition, • Construction, • Uses • Types • Care of cassette	15
UNIT-III	**INTENSIFYING SCREENS:** • Definition • Constructions • Different layers • Uses • Types	15

UNIT-IV	**RADIOGRAPHIC FILM:** • Definition, • Different layers, • Different types of Radiographic film • Handling and storage of Radiographic film.	**10**

COURSE OUTCOME:

BRAD 2302.1	This course deals with the fundamental of dark room techniques, safe light test, preparation of developer, fixer and its chemistry, design and planning of dark room, processing of exposed films, care of intensifying screens.
BRAD 2302.2	This study deals with the storage of unexposed films, accessories of dark room, care of intensifying screens, storage of unexposed films.
BRAD 2302.3	This course is designed to know about the meaning of Radiographic contrast, Density, Resolution, Sharpness, Magnification, Distortion, Un-sharpness, Fog and Latent image.
BRAD 2302.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- Darkroom and Image Processing In Diagnostic Radiology (English, Paperback, Yogesh Kumar)

SUBJECT TITLE: RADIOGRAPHIC PROCEDURE 1

SUBJECT CODE: BRAD-2303

SEMESTER: III

CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-	-	5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVE:

This course is designed to study about the different radiographic procedures of urinary tract, biliary tract and female genital tract.

Sr.No	Contents	HOURS
UNIT-I	**URINARY TRACT:** • I.V.P • RGU • MCU	10
UNIT-II	**BILIARYTRACT:** • Oral Cholecystography • Hepatic percutaneous cholangiography • Pre-operative cholangiography • T-tube cholangiography • E.R.C.P.	15
UNIT-III	**GASTROINTESTINAL TRACT:** • Ba swallow • Ba meal, • Ba-Meal following through • Ba enema • Double contrast enema	15
UNIT-IV	**FEMALE GENITAL TRACT:** • Hystero - salpinography	8

COURSE OUTCOME:

BRAD 2303.1	Aims to provide knowledge on I.V.P, Retrgrade pyelography, Cystourethrography, Oral Cholecystography, Hepatic percutaneous cholangiography, pre-operative cholangiography, T-tube cholangiography, E.R.C.P.
BRAD 2303.2	The study includes knowledge about various special radiographic procedures such as Gastrointestinal tract Ba swallow, Ba meal, Ba- Meal following through, Ba enema. Double contrast enema.
BRAD 2303.3	This course is designed to know about the Female genital tract: , Hysterosalpinography, pelvimetry
BRAD 2303.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Books:
Fundamentals of Special Radiographic Procedures

SUBJECT TITLE: RADIOGRAPHIC PROCEDURE-11
SUBJECT CODE: BRAD-2304
SEMESTER: III

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-		5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVE:

This course is designed to know about the Special Radiological investigation - IVP, Retrograde pyelography, cystourethrography, PTC, ERCP, Ba. Swallow, Meal, enema, HSG, Angiography.

Sr.No	Contents	HOURS
UNIT-I	**ANGIOGRAPHY:** • Carotid Angiography • Femoral arteriography • Cardiac catheterization	15
UNIT-II	**CNS:** • Ventricle imaging • Study of spinal cord	10
UNIT-III	**VENOGRAPHY:** • SPLENOPROTOVENOGRAPHY • Superior • VENOGRAPHY • Lymphangiography	8
UNIT-IV	**SPECIAL PROCEDURES IN DIAGNOSTIC RADIOLOGY:** • The renal tract • Intravenous urography • Intravenous cholangiography operative • Post-operative cholangiography	10

COURSE OUTCOMES:

BRAD2304.1	This course deals with the various angiographic techniques including Carotid Angiography, Femoral arteriography, Aortography Cardiac catheterization
BRAD 2304.2	This study deals with various radiographic examinations such as Ventriculography, Myelography**,** Pneumoencephalography and Shuntography.
BRAD 2304.3	This subject is designed to impart fundamental knowledge about the Splenoprotovenography, Venography, Lymphangiography The respiratory tract examination known as Bronchography. Guided procedures, General preparation care and techniques, After care and Risk.
BRAD 2304.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **Radiological Procedures - A Guideline By Bhushan N. Lakhkar**

SUBJECT TITLE: DARK ROOM TECHNIQUE PRACTICAL

SUBJECT CODE: BRAD – 2371

SEMESTER: III

CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
-	-	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This study deals with the dark room techniques, safe light test, preparation of developer, fixer and its chemistry, design and planning of dark room, processing of exposed films, care of intensifying screens, storage of unexposed films, Accessories of darkroom, care of intensifying screens, storage of unexposed films.

Sr.No	Contents	Hours
UNIT-I	**DARKROOM PROCEDURES TECHNIQUE:** • Dark room techniques, safe light test, preparation of developer, fixer and its chemistry • Design and planning of dark room, processing of exposed films, care of intensifying screens, • storage of unexposed films • Accessories of dark room • Care of intensifying screens, storage of unexposed films.	25

COURSE OUTCOMES:

BRAD 2371.1	This course deals with the fundamental of dark room techniques, safe light test, preparation of developer, fixer and its chemistry, design and planning of dark room, processing of exposed films, care of intensifying screens.
BRAD 2371.2	This study deals with the storage of unexposed films, accessories of dark room, care of intensifying screens, storage of unexposed films.
BRAD 2371.3	This course is designed to know about the meaning of Radiographic contrast, Density, Resolution, Sharpness, Magnification, Distortion, Un-sharpness, Fog and Latent image.
BRAD 2371.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

SUBJECT TITLE: RADIOGRAPHIC PROCEDURE PRACTICAL 1 & 11

SUBJECT CODE: BRAD – 2372

SEMESTER: III

CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
-	-	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course is designed to know about the Special Radiological investigation - IVP, Retrograde pyelography, cystourethrography, PTC, ERCP, Ba. Swallow, Meal, enema, HSG, Angiography.

Sr.No	Contents	
	. Special Radiological investigation - IVP, Retrograde PTC, ERCP, Ba. Swallow, Meal, enema HSG, Angiography.	20

COURSE OUTCOME:

BRAD 2372.1	The course is designed to provide practical knowledge of various radiological procedures such as I.V.P, Retrograde pyelography, Cystourethrography.
BRAD 2372.2	This study helps the students to understand about Ba swallow, Ba meal, Ba- Meal following through, Ba enema, Double contrast enema
BRAD 2372.3	This course deals with the post-operative cholangiography percutaneonus transhepatic cholangiography.
BRAD 2372.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **RADIOLOGICAL PROCEDURES - A GUIDELINE BY BHUSHAN N. LAKHKAR**

SUBJECT TITLE: PATIENT CARE IN DIAGNOSTIC RADIOLOGY
SUBJECT CODE: BRAD- 2401
SEMESTER: III
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3hrs

COURSE OBJECTIVE:

This main aim of this course is to study about the first contact with patients in the department, management of chair and stretcher and aids for this, management for unconscious patient, hygiene in relation to patient. Departmental instruction to patients or ward staff, methods of patients care before and after special x-ray examination. Emergency drugs in radiology department.

Sr.No	Contents	HOURS
UNIT-I	**HOSPITAL PROCEDURE**: • Hospital staffing and organization, record relating to patients. • Professional attitude of the technologist, medico legal aspects, outpatient and follow up clinics, stock taking and stock keeping.	15
UNIT-II	**PREPARATION OF PATIENTS FOR GENERALRADIOLOGICALPROCEDURES**: • Departmental instruction to patients or ward staff, methods of patients care before and after special x-ray examination (for example in neurological vascular and respiratory conditions). • Diabetic patient special attention to food hazards.	15
UNIT-III	**CARE OF PATIENT:** • FIRST contact with patients in the department, management0 of chair and stretcher and aids for this • Management for unconscious patient, hygiene in relation to patient.	15

UNIT-IV	**FIRSTAID:** • Aims and objectives of first aid, wounds and bleeding, dressing and bandage, shock, resuscitation • use of suction apparatus, administration of oxygen, fractures, foreign bodies.	15

COURSE OUTCOMES:

BRAD 2401.1	This course is designed to study about the hospital staffing and organization, record relating to patients, professional attitude of the technologist, medico legal aspects, outpatient and follow up clinics, stock taking and stock keeping.
BRAD 2401.2	This subject is designed to impart basic knowledge about the departmental instruction to our patients or ward staff, methods of patients care before and after special x-ray examination (for example in neurological vascular and respiratory conditions). Diabetic patient special attention to food hazards.
BRAD 2401.3	This study deals with the aims and objectives of first aid, wounds and bleeding, dressing and bandage, shock, resuscitation, use of suction apparatus, administration of oxygen, fractures, foreign bodies.
BRAD 2401.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Book:

- **Patient Care in Radiography with an Introduction to Medical Imaging by Ruth Ann Ehrlich and Dawn M Coakes.**

SUBJECTTITLE: HEALTH CARE MANAGEMENT
SUBJECT CODE: BRAD- 2407
SEMESTER: III
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3hrs

Course Objectives:

This main aim of this course is to provide an insight into core concept, theories and accounting practice Which are adapted and practice on day-to-day basis in the organization.

Contents of Syllabus:

Sr. No	Contents	HOURS
UNIT-I	**Health Care Policies and Regulations:** National Policy for Rare Diseases, 2021. National Health Policy, 2017. National Mental Health Policy, 2014.	8
UNIT-II	**Disease Control Management:** Principle of disease management exclusion, eradication, protection, resistance, therapy, and avoidance of insect vectors and weed hosts.	10
UNIT-III	**Health Care Economics:** Efficiency, effectiveness, value and behavior in the production and consumption of health and healthcare.	10
UNIT-IV	**Health Care Planning:** Assessment, Diagnosis, outcomes and planning, implementation, Evaluation.	13
UNIT-V	**Health Care Legislation:** Health Laws, Act and Regulation in India	10

Course Outcomes:

BRAD 2407.1	This course is designed to develop analytical and problem-solving skills which are required by administrators,
BRAD 2407.2	This will help students to acquire understanding of the function of management and administration of the healthcare business.
BRAD2407.3	This study acquires and practice leadership and managerial skills that will positively affect performance as a healthcare manager.
BRAD 2407.4	Students will be train with good clinical skills related to radiology imaging techniques which will lead to entrepreneurial qualities and employability.

Recommended Book:

- **SharonB. Bucthbinder:** Introduction to healthcare management.
- **Gupta Joydeep Das:** Hospital Administration and management.
- **Charles. R. McConell:** Hospitals and health system.

SUBJECT TITLE: RADIATION HAZARD CONTROL AND SAFETY
SUBJECT CODE: BRAD – 2402
SEMESTER: IV
CONTACTHOURS/WEEK:

Lecture (L)	Tutorial(T)	Practical(P)	Credit I
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This study deals with the principles, history &development-National& international agencies, AERB, BARC, ICRP, WHO,IAEA and their role, effects on cell-stochastic & deterministic effects-radiation risk-tissues at risk-genetic, somatic &fetus risk-risk at other industries, personnel monitoring device, radiation emergency situation and preparedness.

Sr.No	Contents	HOURS
UNIT-I	**RADIATION PROTECTION**: • Principles, history & development-National & international agencies, AERB, BARC, ICRP, WHO, IAEA and their role. • Equivalent dose- effective dose Sievert- rem. • Sources of radiation-natural manmade &internal exposures.	12
UNIT-II	**BIOLOGICAL EFFECTS OF RADIATION:** • Effects on cell-stochastic & deterministic effects-radiation risk-tissues at risk-genetic, somatic& fetus risk-risk at other industries. • Does equivalent limits philosophy-ICRP (60) AERB guidelines.	15
UNIT-III	**PLANNING OF RADIATION INSTALLATION-** • Protection primary, leakage and scattered radiation. • Barrier design, • Design of doors. Effects of time distance and shielding.	10
UNIT-IV	**PERSONNEL MONITORING SYSTEMS:** • Principle and objective, film badge, thermo luminescent dosimeter badge, pocket dosimeter. Area monitoring, survey meter, zone monitor sand phantoms. .	9

COURSE OUTCOMES:

BRAD 2402.1	This course deals with the basic principles, history & development-National & international agencies, AERB, BARC, ICRP, WHO, IAEA and their role. Equivalent dose- effective dose Sievert-rem. Sources of radiation-natural man made & internal exposures.
BRAD 2402.2	This subject is designed to impart knowledge about the radiation effects stochastic & deterministic effects-radiation risk-tissues at risk-genetic, somatic& fetus risk-risk at other industries. Does equivalent limits philosophy-ICRP (60) AERB guidelines.
BRAD 2402.3	The main objective of this course is to understand about leakage and scattered radiation. Barrier design, Design of doors. Effects of time distance and shielding.
BRAD 2402.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended books:

- **Textbook of Radiological Safety by Thayalan**

SUBJEC TTITLE: COMPUTED TOMOGRAPHY

SUBJECT CODE: BRAD- 2403

SEMESTER: IV

CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit I
4	-		4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

The main objective of this course is to study about the computed tomography, image reconstruction in CT, image quality in CT, artifacts in CT, recent advancements in computed tomography.

Sr.No	Contents	HOURS
UNIT-I	**PRINCIPAL DATA ACQUISITION CONCEPT:** Image reconstruction, instrumentation, various generator, spiral/helical, single and Multi-slice CT, electron beam CT.	10
UNIT-II	**COMPUTED TOMOGRAPHY:** Various imaging protocols, technique, patient preparation, and CT guided procedures.	20
UNIT-III	**COMPUTED TOMOGRAPHY:** Various imaging protocols, technique, patient preparation and CT guided procedures.	12
UNIT-IV	**IMAGE QUALITY**: Definition, quantum mottle, resolution, pixel, voxel, matrix, field of view, patient exposure.	12

COURSE OUTCOMES:

BRAD 2403.1	The aim of this course is to know about the Principle data acquisition concepts image reconstruction, instrumentation, various generator, spiral/helical, single and Multi-slice CT and electron beam CT.
BRAD 2403.2	The course deals with the study of various imaging protocols, technique, patient preparation and CT guided procedures.
BRAD 2403.3	This study deals with the various artifacts appearing in the computed tomography aliasing or streaks artifact, ring artifact, noise artifact, motion artifact and beam hardening artifact.
BRAD 2403.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **Essentials of Computed Tomography by George B.**

SUBJECT TITLE: QUALITY ASSURANCE IN DIAGNOSTIC RADIOLOGY

SUBJECT CODE: BRAD- 2404

SEMESTER: IV

CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
4		-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3Hrs

COURSE OBJECTIVES:

This study deals with the quality of imaging, QA Activities, QA program meat Radiological faculty level, Record keeping , Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing ;Radio graphs equipment, Fluoroscopic equipment, Mammography equipment, QA Programmed test, Maintenance care of equipment Safe operation of equipment.

Sr.No	Contents	HOURS
UNIT-I	**THE QUALITY OF IMAGING** – • The diagnostic value, reduction of the radiation exposure, Reduction of film wastage and repeat examination, maintenance of various diagnostic and imagine units at their optimal performance.	12
UNIT-II	**QA ACTIVITIES:** • Equipments election phase • Equipment installation and acceptance phase • Operational phase • Preventive maintenance	10
UNIT-III	**QA PROGRAMME AT RADIOLOGICAL FACULTY LEVEL**: • Responsibility, Purchase, Specifications; Acceptance's Routine testing Evaluation of results of routine testing, Record keeping • Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing • Radio graphs equipment, Fluoroscopic equipment, Mammography equipment, Conventional tomography, Computed tomography, Film processing manual and automatic consideration for storage of film and chemicals.	18

UNIT-IV	**QA PROGRAMMED TEST** : • Light beam alignment: X-ray out-put and beam quality check Kvp check; Focal spot • Size and angle measurement: Timer check; MAs test; Grid alignment test; High and low contrast resolutions Mechanical and electrical checks; test; Field alignment test for fluoroscopic device; • Resolution test; Phantom measurements-CT, US and MRI	10

COURSE OUTCOMES:

BRAD 2404.1	The objective of this course is to study about the diagnostic value, reduction of the radiation exposure, Reduction of film wastage and repeat examination; maintenance of various diagnostic and imagine units at their optimal performance.
BRAD 2404.2	This course deals with study of Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance
BRAD 2404.3	The subject deals with the information regarding quality assurance program Responsibility; Purchase; Specifications; Acceptance's Routine testing Evaluation of results of routine testing; Record keeping, Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radio graphsequipment
BRAD 2404.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **QUALITY ASSURANCE AND CONTROL IN DIAGNOSTIC RADIOLOGY AND IMAGING by BHARGAVA.**

SUBJECT TITLE: PATIENT CARE IN DIAGNOSTIC RADIOLOGY (PRACTICAL)
SUBJECT CODE: BRAD – 2471
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
-	-	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3Hrs

COURSE OBJECTIVES:

This course deals with the fundamentals of the Measuring of pulse, measuring of BP, preparation for Radiological investigations, Allergy test care of Anesthetic Patient, knowledge of catheterization, oxygen administration, biopsy Method, sympathetically and behavioral treatment, care of patients, Care of pregnant patient, non-cooperating child dignity of patient.

Sr.No	Contents	HOURS
SECTION-I	**PRACTICAL KNOWLEDGE OF PATIENT CARE:** • Measuring of pulse, measuring of BP, preparation for Radiological investigations. Allergy test care of Anesthetic, Patient knowledge of catheterization, oxygen administration, biopsy Method, sympathetically and behavioral treatment, care of patients, Care of pregnant patient, non-cooperating child dignity of patient.	20

COURSE OUTCOMES:

BRAD 2471.1	The course deals with the practical knowledge about the Measuring of vital signs such as pulse, measuring of BP, preparation for Radiological investigations
BRAD 2471.2	The course deals with the allergy test care of Anesthetic, Patient knowledge of catheterization, oxygen administration, biopsy Method, sympathetically and behavioral treatment
BRAD 2471.3	The aim of this course is to provide knowledge about the care of patients, Care of pregnant patient, non-cooperating child dignity of patient etc.
BRAD 2471.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

SUBJECT TITLE: COMPUTED TOMOGRAPHY-PRACTICAL

SUBJECT CODE: BRAD- 2472

SEMESTER: IV

CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit I
	-	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

The main objective of this course is to study about the computed tomography, image reconstruction in CT, image quality in CT, artifacts in CT, recent advancements in computed tomography.

Sr.No	Contents	
SECTION-I	**PRACTICAL ON CT:** • Principal and application of different type of CT, different CT protocols selection of anatomical area for scan as per prescription, patient and attendant • Care in CT, image processing, patient positioning on CT table, centering, safety precaution, contrast media, scanning, after care.	20

COURSE OUTCOMES:

BRAD 2472.1	This course is designed to provide practical knowledge about the computed tomography, Principal and application of different type of CT, different CT protocols,
BRAD 2472.2	The aim of this course is to give clinical information of computed tomography how to operate CT machine, Topogram and selection of anatomical area for scan as per prescription, patient and attendant
BRAD 2472.3	This study deals with the Care in CT, image processing, patient positioning on CT table, centering, safety precaution, contrast media, scanning, after care.
BRAD 2472.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Texts:

- **Essentials of Computed Tomography by George.**

SUBJECT TITLE: ULTRASONOGRAPHY AND MAMMOGRAPHY
SUBJECT CODE: BRAD- 3501
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-	-	5

Internal Assessment: 40

End Term Exam: 60

Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course deals with the characteristics of the ultrasound, transducers, their principles and types and there advancement along with mammography there technique, positions, advantages and limitations.

Sr.No	Contents	HOURS
UNIT-I	**ULTRASOUND:** • Physical characteristics of sound • Characteristics of ultrasound beam • Interaction of ultrasound with matter • Ultrasonic display • Imaging principles • Doppler technique.	15
UNIT-II	**TRANSDUCER:** • Definition • Role of transducer • Different types of transducers	15
UNIT-III	**BASIC OF ULTRASONOGRAPHY:** • Principle • Different parts of ultrasonic machine • Modes of display • Mechanism of image	15
UNIT-IV	**ADVANCEMENT IN USG:** • Doppler Ultrasound Types • Duplex Ultrasound, • Imaging technology • Advancement in ultra-sonography	15

COURSE OUTCOMES:

BRAD 3501.1	This course demonstrates the Physical characteristics of sound, characteristics of ultrasound beam, interaction of ultrasound with matter, ultrasonic display, imaging principles.
BRAD 3501.2	It gives detail knowledge about Advancement in USG that is Doppler Ultrasound and its Types, Duplex Ultrasound, Imaging technology Advancement in ultra-sonography
BRAD 3501.3	It gives detail information about basic principle of mammography its construction, views, application.
BRAD 3501.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **Physics and Technical Aspects Diagnostic Ultrasound 1st Edition 2020 by Dinesh K Baghel**

SUBJECTTITLE: RADIOLOGICAL PROCEDURE
SUBJECT CODE: BRAD-3502
SEMESTER: V
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
3	-		3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course deals with all the procedures performs under radiology. Along with the safety measurements for the patient.

Sr.No	Contents	HOURS
UNIT-I	**CONTRAST RADIOGRAPHY:** • Radiological Contrast Media –Classification • Need For Radiological Contrast Media • Methods Of Administration • Reactions To Contrast Media	12
UNIT-II	**SPECIAL PROCEDURE AND RELATED CONTRAST MEDIA:** • IVP/IVU • HSG • DCG • Barium Studies • Interventional Procedures	10
UNIT-III	**MACRO/MICRO RADIOGRAPHY:** • Macro-radiography • Principles • Micro-radiography	10

	• Mass-Miniature Radiography	
UNIT-IV	**HIGH KV TECHNIQUES**: • Introduction • Techniques • Advantages &Disadvantages	4

COURSE OUTCOMES:

BRAD 3502.1	It gives enhance information about Contrast Radiography**,** Radiological Contrast Media – Classification
BRAD 3502.2	It gives detail study about the special Procedure and Related Contrast Media such as IVP/IVU, HSG, DCG, Myelography, Sialography, and Barium Studies.
BRAD 3502.3	It gives detail information about Macro/Micro Radiography**.**
BRAD 3502.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **Textbook of Radiology for Residents & Technicians (English, Paperback, Bhargava S.K.)**

SUBJECT TITLE: INTERVENTIONAL RADIOLOGY
SUBJECT CODE: BRAD- 3503
SEMESTER: V
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-	-	5

Internal Assessment: 40
End Term Exam: 6 0
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course gives detail information about Interventional procedures such as PTC, ERCP, PCN, and FNAC: Fluoroscopy/US/CT guided.

SR.NO	CONTENTS	HOURS
UNIT-I	**INTERVENTIONAL PROCEDURES:** • PTC, ERCP, PCN • FNAC: Fluoroscopy/US/CT guided	18
UNIT-II	**ANGIOGRAPHIC PROCEDURES:** • Vascular/non-vascular • DSA	8
UNIT-III	• RGU • MCU	5
UNIT-IV	**CONTRAST MEDIA:** • Introduction, types of contrast media, routine for introducing contrast media, chemical name of commonly used contrast media. • adverse reaction of iodinated contrast media, toxicity • Emergency equipment, emergency drugs	15

COURSE OUTCOMES:

BRAD 3503.1	This course gives detail information about Interventional procedures such as PTC, ERCP, PCN, and FNAC: Fluoroscopy/US/CT guided
BRAD 3503.2	It gives detail study about the Angiographic procedures such as Vascular/non-vascular, DSA and also RGU, MCU, Cystography, Hypotonic Duodenography, Loopogram.
BRAD 3503.3	It gives detail information about Introduction, types of contrast media, routine for introducing contrast media, and chemical name of commonly used contrast media, adverse reaction of iodinated contrast media, toxicity, emergency equipment, and emergency drugs.
BRAD 3503.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **Handbook of Interventional Radiologic Procedures by Krishna Kandarpa (Author), Lindsay Machan (Author), Janette Durham** .

SUBJECT TITLE: MAGNETIC RESONANCE IMAGING
SUBJECTCODE: BRAD-3504
SEMESTER: V
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course deals with the principle, instrumentation of MRI along with the preparation of patient, artifacts and advantages and disadvantages.

Sr.No	Contents	HOURS
UNIT-I	**MRI SCANNERS**: • History – Principle of MRI, • Instrumentation- hard ware • MR system components • biological effects of MRI • Difference between CT and MRI. MRI contrast media. MRI advantage and disadvantage.	10
UNIT-II	**PATIENT PREPARATION AND POSITIONING:** • Magnetic Resonance Imaging. • Different positioning • Patient preparation for MRI • Specific patient preparation according to the investigation, post care, risk, complication.	10
UNIT-III	**IMAGE QUALITY IN MRI:** • Spatial resolution, contrast resolution	10

	• MRI phantom • MRI artifact, different coils used-image acquisition– reconstructions.	
UNIT-IV	• TR, TE, T1 weighted and T2 weighted images. • Pulse Sequence - spin echo and fast spin echo sequence. • MRI Brain and MRI spine protocol with cross-sectional anatomy.	**10**

COURSE OUTCOMES:

BRAD 3504.1	This course gives detail information about History – Principle of MRI, Instrumentation-hard ware-MR system components, biological effects of MRI, difference between CT and MRI. MRI contrast media. MRI advantage and disadvantage
BRAD 3504.2	It gives detail study about the Patient Preparation and Position in Magnetic Resonance Imaging.Different positioning- Patient preparation for MRI, Specific patient preparation according to the investigation, post care, risk, and complication.
BRAD 3504.3	It gives detail information about **I**mage quality in MRI: Spatial resolution, contrast resolution, MRI phantom, MRI artifact, different coils used - image acquisition – reconstructions.
BRAD 3504.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Books:

- **MRI in Practice Paperback – Illustrated by Catherine Westbrook (Author), John Talbot (Author).**

SUBJECT TITLE: RADIOLOGICAL PROCEDURE PRACTICAL
SUBJECT CODE: BRAD-3571
SEMESTER: V
CONTACTHOURS/WEEK:

LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	CREDIT(C)
-	-	**2**	**2**

Internal assessment: 40
End term exam: 60
Duration of exam: 3hrs

OBJECTIVE AND OUTCOME OF COURSE:

This course deals with the Special investigation, positions for all the special Radiological procedures.

Sr.No	Contents	
SECTION-I	**PRACTICAL:** ● Radiography Special investigation ● Radiographyinvariouspositionsforallthespecia lRadiologicalproceduresusingcontrastmediaas perthesyllabus. ● Mentioned topics in the theory syllabus.	**20**

COURSE OUTCOMES:

BRAD 3571.1	This course gives detail information about Radiography Special investigation.
BRAD 3571.2	It gives detail study about Radiography in various positions for all the special Radiological procedures using contrast media.
BRAD 3571.3	It gives detail information about Macro/Micro Radiography.
BRAD 3571.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Books:

- **Radiological Procedures - A Guideline Paperback – 1 January 2019 by Bhushan N. Lakhkar (Author)**

SUBJECT TITLE: INTERVENTIONAL RADIOLOGY -PRACTICAL
SUBJECT CODE: BRAD-3572
SEMESTER: V
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
-	-	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3hrs

COURSE OBJECTIVES:

This course deals with the adverse reaction of iodinated contrast media, toxicity, emergency equipment, emergency drugs.

PRACTICAL

S.NO.	CONTENT	HOURS
1	PTC, ERCP, PCN, and FNAC: Fluoroscopy/US/CT guided Introducing contrast media, chemical name of commonly used contrast media, and adverse reaction of iodinated contrast media, toxicity, emergency equipment, and emergency drugs.	20

COURSE OUTCOMES:

BRAD 3572.1	This course gives detail information about Interventional procedures such as PTC, ERCP, PCN, and FNAC: Fluoroscopy/US/CT guided
BRAD 3572.2	It gives detail study about the Angiographic procedures such as Vascular/non-vascular, DSA and also RGU, MCU, Cystography, Hypotonic Duodenography, Loopogram.
BRAD 3572.3	It gives detail information about Introduction, types of contrast media, routine for introducing contrast media, and chemical name of commonly used contrast media, adverse reaction of iodinated contrast media, toxicity, emergency equipment, and emergency drugs.
BRAD 3572.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **Handbook of Interventional Radiologic Procedures by Krishna Kandarpa (Author), Lindsay Machan (Author), Janette Durham (Author)**

SUBJECTTITLE: MAGNETIC RESONANCE IMAGING

SUBJECTCODE: BRAD-3601
SEMESTER: 6
CONTACTHOURS/WEEK:

LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	CREDIT (C)
5	-		5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3hrs

COURSE OBJECTIVES:

This course deals with the principle, instrumentation of MRI along with the preparation of patient, artifacts and advantages and disadvantages, multiple sequences performed in MRI.

Sr.No	Contents	Contact Hours
UNIT-I	**NMR:** • Chemical shift, Relaxation, general mechanism, longitudinal relaxation time. Transverse (T2)relaxation time • Effect of filed in homogeneities, T2 Standard sequence, and ultra-fast sequences. • Pulse sequence, Inversion recovery and STIR. Spin echo Gradient sequences; MR Angiography.	**15**
UNIT-II	**MRI:** • The Fourier transform and The FID 2D-Fourier transform • Reconstruction methods. • Imaging Technique Gradient Magnetic Interleaved MultiImaging.3DFourierTransform reconstruction methods.	**15**
UNIT-III	**IMAGING QUALITY**: • Effects of flow Instrumentation. Safety and contra-indication. • MRI in practice. One-dimensional imaging: frequency encoding using magnetic field gradient two dimensional	**15**

	imaging: phase encoding slice selection (3Dto2D) gradient echoes.	
UNIT-IV	**MRI FUNCTIONAL:** Introduction to in Vivo/MR-Spectroscopy, spectroscopic Imaging (CSI) Processing, Advanced pulse sequences and techniques. Clinical	**10**

COURSE OUTCOMES:

BRAD 3601.1	This course gives detail information about Chemical shift, Relaxation, general mechanism, Longitudinal (Tr) relaxation time. Transverse (T2) relaxation time, effect of filed in homogeneities, T2 Standard sequence, and ultra-fast sequences. Pulse sequence, Inversion recovery and STIR. Spin echo Gradient sequences; MR Angiography.
BRAD 3601.2	It gives detail study about the Fourier transform and The FID 2D-Fourier transform reconstruction methods. Imaging Technique Gradient Magnetic Inter leaved Multi Imaging. 3D Fourier Transform reconstruction methods
BRAD 3601.3	It gives detail information about Imaging Qualityy, effects of flow Instrumentation. Safety and contra-indication. MRI in practice. One-dimensional imaging: frequency encoding using magnetic field gradient two-dimensional imaging: phase encoding slice selection (3D to 2D) gradient echoes.
BRAD 3601.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Books:

- **MRI in Practice Paperback – Illustrated, 26 October 2018 by Catherine Westbrook (Author), John Talbot (Author).**

SUBJECTTITLE: RECENT ADVANCEMENT IN RADIOLOGY

SUBJECT CODE: BRAD- 3602
SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-	-	5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3HRS

COURSE OBJECTIVES:

This course deals with the development seen in x rays , mammography, USG, CT, MRI and also PACS, DICOM.

Sr.No	Contents	Contact Hours
UNIT-I	**XRAY:** • Recent development in x-ray technology, Advancements in H.T. generators, CR VS DR, portable x-ray unit, DEXA scan, Fluoroscopy.	**15**
UNIT-II	**Ultrasound Scanning:** • Doppler Ultrasound, Duplex Ultrasound-Endosonography	**10**
UNIT-III	**COMPUTED TOMOGRAPHY**: • Cone beam CT, MDCT ,new detector technology • Spectral CT imaging, dual source Scanner, pressure injector, EBCT, Catheterization, History, Technique, Patient care, catheterization • Catheterizationsites,Asepsis,Guidewire,catheters,Accessories,cardiaccatherization:PTCA,CAG	**15**
UNIT-IV	• MRA, Lungs MRI, Cardiac MRI, MRI Scanner, Spectroscopy	**10**

COURSE OUTCOMES:

BRAD 3602.1	This course gives detail information about X RAY: Recent development in x-ray technology, Advancements in H.T. generators, CR VS DR, portable x ray unit, DEXA scan, Fluoroscopy.
BRAD 3602.2	It gives detail study about the Ultrasound Scanning, Doppler Ultrasound, Duplex Ultrasound- Endosonography, Mammography-Equipment Positioning & Projections-Xero-Radiography, digital mammography.
BRAD 3602.3	It gives detail information about CT: cone beam CT, MDCT, new detector technology, Spectral CT imaging, dual source Scanner, pressure injector , EBCT , Catheterization : History , Technique , Patient care , Percutaneous catheterization , Catheterization sites , Asepsis , Guidewire , catheters , Accessories , cardiac catheterization : PTCA , CAG , PPI , BMV , AVR , MVR , ERCP and MRCP
BRAD 3602.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- **Essentials of Radiology by Rajesh Raman (Author), H N Pradeep (Author)**

SUBJECTTITLE: GENERAL MICROBIOLOGY

SUBJECTCODE: BRAD- 3606
SEMESTER: 6
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
5	-	-	5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3HRS

Course Objectives:

- To introduce basic principles and then applies clinical relevance in four segments of the academic preparation for paramedical: immunology, bacteriology, mycology, and virology.
- This rigorous course includes many etiological agents responsible for global infectious diseases.

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	**Concepts and Principles of Microbiology-** Historical Perspective, Koch's Postulates, importance of microbiology, microscopy, classifications of microbes.	15
UNIT-II	**Sterilization and Disinfection-** Concept of sterilization, Disinfection asepsis, physical method of sterilization, chemical methods.	10
UNIT-III	**7Infection Control:** infection, sources, standard safety precautions and hand hygiene, hospital acquired infection and hospital infection control.	15
UNIT-IV	**Virology:** Common viral eye infection, general properties , outlines of a diagnosis and classification, HIV Virus, Hepatitis-B Virus	15
UNIT-V	**Immunity:** Classifications, antigen, antibody- definition and its types, Ag- Abreactions- Types and examples, procedure of investigation and confidentiality.	10

Course Outcomes:

BRAD3605.1	This course gives knowledge of microorganisms and the disease process as well as aseptic and sterile techniques.
BRAD 3605.2	It gives detail study about laboratory procedure according to appropriate safety standards.
BRAD 3605.3	This course gives knowledge and uses of the properties of microorganisms
BRAD 3605.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Books:

- Fundamentals of Microbiology by **Jeffrey C. Pommerville.**
- Textbook of Microbiology by **Dr. C P Baveja.**

Program Name: B.Sc. Radiology and Imaging Technology
Programme Code: RIT-301

SUBJECT TITLE: NUCLEAR IMAGING TECHNIQUES
SUBJECT CODE: BRAD- 3603
SEMESTER: 6
CONTACTHOURS/WEEK:

LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	CREDIT (C)
5	0	0	5

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course deal with the nuclear physics, procedures constructions, principles and also the advantages and limitations.

Sr.No	Contents	Contact Hours
UNIT-I	• Nuclear physics, procedures, constructions • Principles and also the advantages and limitations.	10
UNIT-II	**NUCLEAR SCAN PROCEDURES:** • SPECT-CT&PET-CT studies • Protocols, Basics of common clinical Nuclear Medicine • Procedures/techniques–comparison with different structural imaging studies advantages and limitations, Half-life of Radio nuclides, commonly used radio-nuclides.	15
UNIT-III	**THERAPEUTIC PROCEDURES:** • ,radioactivity: discovery, natural and artificial radioactivity isotopes and nuclides • Bindings forces between nuclear particles–alpha and beta particles .	10
UNIT-IV	**GAMMA CAMERA**: • Constructions and principle of operation • Collimator, PMT, amplifier, data analysis computer, display, gantry, applications and functions.	15

COURSE OUTCOMES:

BRAD 3603.1	This course gives detail information about Nuclear Physics - basics in Nuclear Imaging, Gamma Cameras- radioisotope- generators-SPECT-CT & PET-CT- advantages limitations, Various CT protocols.
BRAD 3603.2	It gives detail study about nuclear scan procedures: SPECT-CT & PET-CT studies, protocols, Basics of common clinical Nuclear Medicine procedures/techniques– comparison with different structural imaging studies advantages and limitations, Half-life of Radionuclides, commonly used radionuclides.
BRAD 3603.3	It gives detail information about therapeutic procedures-IGRT, TACE & TARE etc., radioactivity: discovery, natural and artificial radioactivity isotopes and nuclides binding's forces between nuclear particles – alpha and beta particles.
BRAD 3603.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

RECOMMENDED BOOKS:

- Textbook of Radiology for Residents and Technicians by **BHARGAVA S. K** (Author)

SUBJECT TITLE: MAGNETIC RESONANCE IMAGING -PRACTICAL
SUBJECT CODE: BRAD-3671
SEMESTER: 6
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit I
-	-	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

COURSE OBJECTIVES:

This course deals with the patient preparation, centering, MRI planning, safety of patients in MRI, aftercare, contrast in MRI.

Sr.No	Contents	Contact Hours
SECTION-I	**PRACTICAL** • Patient preparation, • centering, • MRI planning, • Safety of patients in MRI • aftercare, • contrast in MRI	25

COURSE OUTCOMES:

BRAD 3671.1	This course gives detail information about Chemical shift, Relaxation, general mechanism, Longitudinal (Tr) relaxation time. Transverse (T2) relaxation time, effect of filed in homogeneities, T2 Standard sequence, and ultra-fast sequences. Pulse sequence, Inversion recovery and STIR. Spin echo Gradient sequences; MR Angiography.
BRAD 3671.2	It gives detail study about the Fourier transform and The FID 2D-Fourier transform reconstruction methods. Imaging Technique Gradient Magnetic Inter leaved Multi Imaging. 3D Fourier Transform reconstruction methods
BRAD 3671.3	It gives detail information about Imaging Qualityy, effects of flow Instrumentation. Safety and contra-indication. MRI in practice. One-dimensional imaging: frequency encoding using magnetic field gradient two-dimensional imaging: phase encoding slice selection (3D to 2D) gradient echoes.
BRAD 3671.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

SUBJECT TITLE: **BIOSTATISTICS & RESEARCH METHODOLGY**

SUBJECTCODE: BRAD- 3604
SEMESTER: 6
CONTACTHOURS/WEEK:

Lecture(L)	Tutorial(T)	Practical(P)	Credit (C)
3	-	-	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3HRS

Course Objectives: Demonstrate knowledge and understanding of statistical theory to select appropriate study designs to address questions for research and to apply appropriate statistical techniques for managing common types of medical data.

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	**INTRODUCTION** Importance of statistics in behavioral sciences – Descriptive statistics and inferential statistics – Usefulness of quantification in behavioral sciences. Measurements – Scales of measurements – Nominal, Ordinal, Interval and Ratio scales. Cumulative frequency curve – Drawing inference from graph. Measures of central tendency – Need – types: Mean, Median, Mode – Working out these measures with illustrations. Measures of variability – Need – Types: Range, Quartile deviation, Average deviation, Standard deviation, Variance – Interpretation.	15
UNIT-II	**RESEARCH METHODS**: Research Meaning- Scope and Objectives –.Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph,	15

UNIT-III	**DATA COLLECTION AND SAMPLING:** Data collection – Classification of data – Class intervals – Continuous and discrete measurements validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing. Correlation Tests of significance- need for – significance of the mean – sampling error – significance of differences between means – interpretation of probability levels – small samples – large samples.	**15**

Course Outcomes:

BRAD 3604.1	Understand the limitations of particular research methods. Develop skills in qualitative and quantitative data analysis and presentation. Develop advanced critical thinking skills. Demonstrate enhanced writing skills.
BRAD 3604.2	Demonstrate knowledge and understanding of statistical theory.
BRAD 3604.3	Biostatistics uses the application of statistical methods to conduct research in the areas of biology, public health, and medicine.
BRAD 3604.4	Students will be train with good clinical skill related to radiology imaging techniques which leads to entrepreneurial qualities and employability.

Recommended Books:

- Research Methodology and Biostatistics by **Srivastava Sumeet, Suman, Usman**
- Research Methodology : Methods And Techniques By Dr Rk Jain

7th Semester & 8th semester

INTERNSHIP

Program Name: B.Sc. Radiology and Imaging Technology
Programme Code: RIT-301