GURU KASHI UNIVERSITY

Bachelor in Medical Radiology & Imaging Technology (BR&IT)

Single Major (Annexure- III)

Session: 2025-26

Faculty of Health and Allied Science

Graduate Attributes of the Programme: - Bachelor of Radiology Imaging Technology

Type of learning outcomes	**The Learning Outcomes Descriptors**
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/interdisciplinary areas of learning	Explain the fundamental principles of medical imaging modalities, including X-ray, CT, MRI, ultrasound, nuclear medicine, and fluoroscopy.
	Perform patient positioning and imaging techniques for different radiographic examinations.
	Stay updated with emerging imaging technologies like AI-assisted radiology and functional imaging.
	Demonstrate effective communication and empathy when dealing with patients.
Generic learning outcomes	Demonstrate a strong foundation in anatomy, physiology, pathology, and medical physics relevant to radiology and imaging.
	Explain the fundamentals of radiation physics, radiation protection, and dosimetry in compliance with international safety standards (e.g., ICRP, AERB).
	Operate and maintain radiology equipment, including X-ray, fluoroscopy, CT, MRI, DEXA, ultrasound, and PACS systems.
	Follow infection control, sterilization, and emergency protocols in the radiology department.
	Exhibit compassion and patient-centered care, ensuring comfort and safety during imaging procedures.

Programme Learning outcomes: An Undergraduate Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 4.5:

Element of the Descriptor	**Programme learning outcomes relating to Undergraduate Certificate**
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Apply theoretical knowledge to real-world situations and problems.
	Exhibit understanding of the historical, cultural, or ethical context of the discipline.
	Analyze and evaluate complex issues, drawing on relevant data and research findings.
General, technical and professional skills required to perform and accomplish tasks	Develop and apply practical skills relevant to the profession or discipline.
	Communicate clearly and persuasively, both orally and in writing, to a variety of audiences.
	Present information logically, using appropriate formats and media.
Application of knowledge and skills	Demonstrate understanding of ethical principles and the ability to apply them in professional contexts.
Generic learning outcomes	Demonstrate openness to new ideas, technologies, and methods within the field.
Constitutional, humanistic, ethical, and moral values	Demonstrate understanding of ethical principles and the ability to apply them in professional contexts.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Maintain a professional attitude, appearance, and conduct in a work environment.
	Prioritize tasks effectively to manage multiple responsibilities in a time-sensitive manner.
	Demonstrate the ability to take on leadership roles when appropriate.
Credit requirements	The successful completion of the first year (two semesters) of the undergraduate programme of 44 credit hours followed by an exit 4-credit of internship (Total 48 Credits)

Entry requirements	10+2 Medical/Non-Medical with at least 45% in the aggregate.

SEMESTER: 1st									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No. of Credits**	**Int.**	**Ext.**	**Total Marks**
BRI1100	General Anatomy	Core Course Theory	3	0	0	3	30	70	100
BRI1101	General Physiology	Core Course Theory	3	0	0	3	30	70	100
BRI1102	Basic Radiation Physics I	Minor Course	4	0	0	4	30	70	100
BRI1103	Introduction to quality and patient safety	Skill Enhancement Course	3	0	0	3	30	70	100
BRI1104	Human Rights and Duties	Multidisciplinary Course	3	0	0	3	30	70	100
BRI1105	General Anatomy Lab	Core Course Practical	0	0	2	1	30	70	100
BRI1106	General Physiology Lab	Core Course Practical	0	0	2	1	30	70	100
BRI1107	English for Professionals	Ability Enhancement Course	2	0	0	2	30	70	100
VAC0001	Environment Education	Value Added Course	2	0	0	2	30	70	100

Total	**20**	**00**	**04**	**22**	**270**	**630**	**900**

SEMESTER: 2nd									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No. of Credits**	**Int.**	**Ext.**	**Total Marks**
BRI2150	Radiological And Imaging Equipment's	Core Course Theory	3	0	0	3	30	70	100
BRI2151	Basic Radiation Physics II	Minor Course	4	0	0	4	30	70	100
BRI2152	Computer Applications	Skill Enhancement Course	3	0	0	3	30	70	100
BRI2153	Nutrition	Multidisciplinary Course	3	0	0	3	30	70	100
BRI2154	Radiological And Imaging Equipment's Lab	Core Course Practical	0	0	2	1	30	70	100
BRI2155	Communication and Presentation Skills	Ability Enhancement Course	2	0	0	2	30	70	100
VAC0002	Human Values and Professional Ethics	Value Added Course	2	0	0	2	30	70	100
DISCIPLINE SPECIFIC ELECTIVE COURSE (Choose any one of them)									
BRI2156	Radiation Protection	Discipline Specific elective course	4	0	0	4	30	70	100
BRI2157	Biomedical waste Management								

Total	**21**	**00**	**02**	**22**	**240**	**560**	**800**

Programme learning outcomes: An Undergraduate Diploma is awarded to students who have demonstrated the achievement of the outcomes located at level 5:

Element of the Descriptor	**Programme learning outcomes relating to Undergraduate Diploma**
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Demonstrate a foundational understanding of key concepts, principles, and theories relevant to the discipline.
	Apply core disciplinary knowledge to address basic problems and situations within the field.
	Understand the historical, cultural, social, or ethical context in which the discipline operates.
Skills required to perform and accomplish tasks	Demonstrate professionalism and ethical behavior in academic, workplace, or field-based activities.
	Recognize and apply relevant ethical standards in decision-making and problem-solving.
Application of knowledge and skills	Develop critical thinking and problem-solving abilities to evaluate and address simple to moderate issues within the field.
Generic learning outcomes	Set and pursue learning and career goals, demonstrating a commitment to continuous professional development.
Constitutional, humanistic, ethical, and moral values	Demonstrate responsibility and accountability in completing tasks and fulfilling commitments.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Apply fundamental practical skills and techniques in a range of common tasks within the field. Demonstrate competence in using industry-standard tools, technologies, and software. Perform basic research, experiments, or projects, ensuring accuracy and attention to detail.
Credit requirements	The successful completion of the 2nd year (four semesters) of the undergraduate programme of 94 credit hours followed by an exit 4-credit of internship (Total 98 Credits)
Entry requirements	Passed UG Certificate course in the BSc. RITwith 44 credits hours followed by a 4-credit of internship.

	Or 3 years DRIT after metric or Passed 2 years DRIT after 10+2 with at least 45%o in the aggregate.

SEMESTER: 3rd									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No. of Credits**	**Int.**	**Ext.**	**Total Marks**
BRI3200	Clinical Radiography Positioning I	Core Course Theory	3	0	0	3	30	70	100
BRI3201	Microbiology and Immunology	Minor Course	4	0	0	4	30	70	100
BRI3202	First Aid	Skill Enhancement Course	3	0	0	3	30	70	100
BRI3203	Disaster Management	Multidisciplinary Course	3	0	0	3	30	70	100
BRI3204	Clinical Radiography Positioning I Lab	Core Course Practical	0	0	2	1	30	70	100
BRI3205	English for Clinical Language	Ability Enhancement Course	2	0	0	2	30	70	100
VAC0003	Hospital Infection Controls and preventations	Value Added Course	2	0	0	2	30	70	100
DISCIPLINE SPECIFIC ELECTIVE COURSE (Choose any one of them)									
BRI3206	Radiographic and imagine processing techniques	Discipline Specific elective course	4	0	0	4	30	70	100
BRI3207	Health Education and Health Communication								
Total			**21**	**00**	**02**	**22**	**240**	**560**	**800**

SEMESTER: 4th									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No. of Credit**	**Int.**	**Ext.**	**Total Marks**
BRI4250	Clinical Radiography Positioning-II	Core Course Theory	3	0	0	3	30	70	100
BRI4251	Special Radiography Procedures I	Core Course Theory	3	0	0	3	30	70	100
BRI4252	Modern radiological & imaging equipment	Core Course Theory	3	0	0	3	30	70	100
BRI4253	Hospital practice and patient care	Minor Course	4	0	0	4	30	70	100
BRI4254	Clinical Radiography Positioning-II Lab	Core Course Practical	0	0	2	1	30	70	100
BRI4255	Special Radiography Procedures I Lab	Core Course Practical	0	0	2	1	30	70	100
BRI4256	Modern radiological & imaging equipment Lab	Core Course Practical	0	0	2	1	30	70	100
BRI4257	English for Research Writing	Ability Enhancement Course	2	0	0	2	30	70	100
BRI4258	Industrial Training	Internship	0	0	0	4	30	70	100
IKS0002	Indian Education	VAC	2	0	0	2	30	70	100
DISCIPLINE SPECIFIC ELECTIVE COURSE (Choose any one of them)									

BRI4259	Newer Imaging Modalities	Discipline Specific elective course	4	0	0	4	30	70	100
BRI4260	Radiation Protection & Management of Radiology Department								
Total			**21**	**00**	**06**	**22**	**330**	**770**	**1100**

Programme learning outcomes: The Bachelor's degree is awarded to students who have demonstrated the achievement of the outcomes located at level 5.5:

Element of the Descriptor	**Programme learning outcomes relating to Bachelor Degree**
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Critically assess contemporary developments, trends, and debates within the field of study.
	Integrate and apply disciplinary knowledge to analyze complex problems and propose innovative solutions.
	Understand and evaluate the historical, cultural, social, ethical, and global context in which the discipline operates.
	Demonstrate in-depth knowledge and understanding of key theories, concepts, principles, and practices within the discipline.
General, technical and professional skills required to perform and accomplish tasks	Develop and defend logical arguments based on sound evidence and critical thinking.
	Apply advanced analytical techniques and tools to address complex challenges or problems in the field.
	Demonstrate the ability to synthesize diverse information and perspectives to make informed decisions.
Application of knowledge and skills	Use specialized tools, techniques, and technologies relevant to the field with a high level of proficiency.
Generic learning outcomes	Conduct independent research, experiments, or projects, ensuring methodological rigor and ethical standards.
Constitutional, humanistic, ethical, and moral values	Exhibit professionalism and ethical behavior in academic, work, and research settings. Show accountability, responsibility, and integrity in all academic and professional tasks.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Apply critical thinking and problem-solving methodologies to real-world challenges and scenarios. Adapt to changing environments and demonstrate flexibility in addressing unforeseen challenges. Take responsibility for tasks, providing guidance and support to team members.
Credit requirements	The successful completion of the 3rd year (six semesters) of the undergraduate programme of 148 credit hours followed by an exit 4-credit of internship (Total 152

	Credits)
Entry requirements	Passed UG Diploma in the BSc. RIT with 94 credits hours followed by a 4-credit of internship. (Total 98)

SEMESTER: 5th									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No of Credits**	**Int.**	**Ext.**	**Total Marks**
BRI5300	MRI Physics	Core Course Theory	3	0	0	3	30	70	100
BRI5301	CT Physics	Core Course Theory	3	0	0	3	30	70	100
BRI5302	Basics of hospital skill learning	Core Course Theory	4	0	0	4	30	70	100
BRI5303	Research Methodology and Biostatics	Minor Course	4	0	0	4	30	70	100
BRI5304	MRI Physics Lab	Core Course Practical	0	0	2	1	30	70	100
BRI5305	CT Physics Lab	Core Course Practical	0	0	2	1	30	70	100
DISCIPLINE SPECIFIC ELECTIVE COURSE (Choose any one of them)									
BRI5306	Cross-Sectional Anatomy & Physiology	Discipline Specific elective course	4	0	0	4	30	70	100
BRI5307	Cardiac Imaging								
DISCIPLINE SPECIFIC ELECTIVE COURSE (Choose any one of them)									
BRI5308	Special Radiography Procedures II	Discipline Specific elective course	4	0	0	4	30	70	100
BRI5309	Physics of Radiotherapy								
Total			**22**	**00**	**04**	**24**	**240**	**560**	**800**

SEMESTER: 6th									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No. of Credits**	**Int.**	**Ext.**	**Total Marks**
BRI6350	Advancement CT MRI and USG	Core Course Theory	3	0	0	3	30	70	100
BRI6351	Quality Assurance And Quality Control	Core Course Theory	4	0	0	4	30	70	100
BRI6352	Research Publication ethics and IPR	Minor Course	4	0	0	4	30	70	100
BRI6353	Advancement CT MRI and USG Lab	Core Course Practical	0	0	2	1	30	70	100
IKS0006	Indian Health science	VAC	2	0	0	2	30	70	100
BRI6354	Industrial Training	Internship	0	0	0	4	30	70	100
DISCIPLINE SPECIFIC ELECTIVE COURSE (Choose any one of them)									
BRI6355	Basic Principle of Hospital Management	Discipline Specific elective course	4	0	0	4	30	70	100
BRI6356	Mentoring and Professional development								
DISCIPLINE SPECIFIC ELECTIVE COURSE (Choose any one of them)									
BRI6357	CT and MRI Protocols	Discipline Specific elective course	4	0	0	4	30	70	100
BRI6358	Orientation in Clinical Sciences								
Total			**20**	**00**	**04**	**26**	**240**	**560**	**800**

Programme learning outcomes: The Bachelor's degree (with Research) or the Post-Graduate Diploma is awarded to students who have demonstrated the achievement of the outcomes located at level 6:

Element of the Descriptor	**Programme learning outcomes relating to Bachelor Degree (with Research)**
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Students should develop skills to present their research through various platforms such as academic conferences, journals, and seminars.
	This involves preparing presentations, creating posters, and engaging in academic discourse.
	Research students should cultivate a habit of self-reflection and a commitment to continuous learning, staying current with new research trends and technological advancements in their field.
	This includes understanding the importance of data integrity, privacy, and confidentiality.
General, technical and professional skills required to perform and accomplish tasks	Research students should be able to critically evaluate existing literature, identify gaps in knowledge, and formulate research questions that contribute to advancing their field of study.
Application of knowledge and skills	Research students should learn how to gather, manage, and analyze data in an ethical manner. This includes understanding the importance of data integrity, privacy, and confidentiality. They should also learn to present complex ideas in a clear and organized manner to both academic and non-academic audiences.
Generic learning outcomes	Research students should be proficient at conducting comprehensive literature reviews to identify and synthesize existing knowledge in their area of study, providing a foundation for their own research.
Constitutional, humanistic, ethical, and moral values	Students should understand and practice ethical principles in conducting research. This includes avoiding plagiarism, ensuring participant confidentiality. obtaining informed consent where applicable.

Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Skills in using research software tools (e.g., data analysis programs like SPSS). The ability to communicate research findings clearly and effectively through both written reports and oral presentations. Analyzing complex problems, considering multiple perspectives, and finding innovative solutions to challenges.
Credit requirements	The successful completion of the 4th year (eight semesters) of the undergraduate programme of 196 credit hours.
Entry requirements	Bachelor's Degree with 148 credits hours followed by a 4-credit of internship. After completing the requirement of a 3 years bachelor's degree, candidates who meet a minimum 75% marks or its equivalent grade will be allowed to continue studies in the 4th year of the Under Graduate programme leading to the Bachelor's Degree with Research.

*The 7th and 8th semester of the Bachelor of Science in Radiology Imaging Technologyprogram focuses on preparing students for professional practice through internships and research work. This semester is crucial as it marks the transition from academic learning to practical application in real-world settings.

Internship and Research Overview:

- During the 7th & 8th semester, Radiology Imaging Technology students engage in both internship and research activities. This period provides students with the opportunity to apply their academic knowledge in clinical settings, interact with patients, and gain hands-on experience. In parallel, students are expected to undertake a research project, contributing to the body of knowledge in the field of Radiology Imaging technology.
- In 7th semester the student will present 1 seminar and submit 1 case study which would be related to his/her topic of research and submission of Synopsis proceed to 8th sem. Dissertation (Phase) I will include Synopsis approval from Doctoral Advisory Committee (DAC) will be taken by the student and after that it will send to Institutional Research Committee (IRC), followed by Institutional Ethical Committee (IEC) for approval.

- In 8th semester as a part of dissertation phase II, dissertation will be evaluated for **300 marks** on the parameter laid down in the proforma for the evaluation in which the students will give a presentation on the dissertation and an open viva-exam examination will be conducted by the external examiner. Student will submit three hard copies of her/his dissertation along with soft copy as PDF file to the Department and 1 Review & Research paper based on his/her research work.
- The Anti-plagiarism policy of the university is to be strictly followed by the candidate and the supervisor.

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SEMESTER: 7th									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**C**	**Int.**	**Ext.**	**Total Marks**
BRI7400	Internship (Six months)	Skill Based	0	0	0	8	30	70	100
BRI7401	Dissertation (Phase I)	Skill Based	0	0	0	12	30	70	100
BRI7402	Seminar	Skill Based	0	0	8	4	30	70	100
BRI7403	Self-Development Report	Ability Enhancement Course	0	0	4	2	30	70	100
Total			**0**	**0**	**12**	**26**	**120**	**280**	**400**

Dissertation (Phase) I will include Synopsis approval from Doctoral Advisory Committee (DAC) will be taken by the student and after that it will send to Institutional Research Committee (IRC), followed by Institutional Ethical Committee (IEC) for final approval.

Self-Development Report will include submission of one case study.

SEMESTER: 8th									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**C**	**Int.**	**Ext.**	**Total Marks**
BRI8450	Internship (Six months)	Core Course	0	0	0	8	30	70	100
BRI8451	Dissertation (Phase II)	Research Based	0	0	0	12	30	70	100
BRI8452	Self-Development Report	Ability Enhancement Course	0	0	4	2	30	70	100
Total			**0**	**0**	**4**	**22**	**90**	**210**	**300**
Grand Total			**126**	**0**	**30**	**192**	**1670**	**2930**	**4600**

Self-Development Report- Student will present progress report of research work in the third month of 8th semester.

Dissertation (Phase) II - Dissertation will be evaluated for **300 marks** on the parameter laid down in the proforma for the evaluation in which the students will give a presentation on the dissertation and an open viva-exam examination will be conducted by the external examiner. Student will submit three hard copies of her/his dissertation along with soft copy as PDF file to the Department and 1 Review & Research paper based on his/her research work.

1ST SEMESTER

Course Title: General Anatomy	L	T	P	Cr.
Course Code: BRI1100	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Recognition of standard anatomical terminology, including terms for movements, positions, and locations of structures.
2. Ability to identify and describe the major bones, muscles, organs, and systems of the body (skeletal, muscular, cardiovascular, nervous, etc.).
3. Understanding how the body's systems work together to maintain balance and regulate internal environments.
4. Ability to relate anatomy to clinical practice, such as understanding how anatomical variations can affect disease and injury.
5. Ability to connect anatomical knowledge with other medical disciplines like physiology, pathology, and pharmacology.

Course Contents

UNIT-I **10 Hours**

Introduction to Human Anatomy: General organization Synopsis of all systems Cell Organization: Structure & function of all cell organelles-cell division (Mitosis and meiosis) Tissues (Definition, classification with structure and function). Tissues of the Body: Epithelium, connective tissue, bone and cartilage, Muscles: Different types of muscles, their functional differentiation, their relationship with different structures, their neural supply

UNIT-II **10 Hours**

Cardiovascular and Respiratory Systems, Anatomy of the heart and circulatory system. Blood vessels: Differentiation between arteries and veins, embryology, histology of both arteries and veins, Functional differences between the two, anatomical differences at different locations. Lymphatic system: Embryology, functions, relationship with blood vessels and organs. Skin and appendages: Embryology, anatomical differences in different areas,

functional and protective variations, innervations, relationship with muscles and nerves.

UNIT-III **10 Hours**

Digestive system: oral cavity, oesophagus, stomach, intestines, and accessory organs (liver, gallbladder, and pancreas). Urinary system: kidneys, ureters, bladder, and urethra. Male reproductive system: anatomy of the testes, epididymis, vas deferens, prostate gland, and penis. Female reproductive system: anatomy and physiology of the ovaries, fallopian tubes, uterus, vagina, and breasts, Development and growth of the reproductive system.

UNIT-IV **15 Hours**

Glands: Embryology, different types of glands (exocrine and endocrine), functional, differences, neural control of glands. Nervous system: Parts of Nervous system, cell types of nervous system, Blood-brain barrier, Reflex arc, Peripheral Nerves, Spinal nerves, Nerve fibres, Autonomic Nervous system. Brain and Cranial nerves: Major parts of Brain, Protective coverings of the Brain, Cerebrospinal Fluid, Brain stem, Cerebellum, Diencephalon, Cerebrum, Cranial nerves.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Moore, K. L., Dalley, A. F., & Agur, A. M. R. (2018). Clinically Oriented Anatomy (8th ed.). Wolters Kluwer.*
- *Drake, R. L., Vogl, W., & Mitchell, A. W. M. (2014). Gray's anatomy for students. Elsevier Health Sciences.*
- *Standring, S. (Ed.). (2016). Gray's anatomy: The anatomical basis of clinical practice. Elsevier Health Sciences.*
- *Netter, F. H. (2019). Atlas of human anatomy. Elsevier Health Sciences.*
- *Snell, R. S. (2014). Clinical anatomy by systems. Lippincott Williams & Wilkins.*
- *Rohen, J. W., Yokochi, C., & Lütjen-Drecoll, E. (2019). Color atlas of anatomy: A photographic study of the human body. Lippincott Williams & Wilkins.*

Course Title: General Physiology	L	T	P	Cr.
Course Code: BRI1101	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Acquire the knowledge of the relative contribution of each organ system in maintenance of the Milieu Interior (Homeostasis)
2. Compare & contrast Functions of lipids, carbohydrates, proteins & cell organelles.
3. Classify Physiological functions of various systems, with special reference to Musculoskeletal, Neuro-motor, Cardio-respiratory, Endocrine, Uro- genital function, & alterations in function with aging
4. Conclude Properties of nerve fibers, function of neuroglia, synapse, CNS, CSF, brain, cranial nerves, demonstration of reflexes.
5. Understanding the relationships between various organs and their role in the overall function of the body.

Course Contents

UNIT-I **10 Hours**

Cell structure & organization: Tissue organization, Epithelium, Connective tissue, Collagen fibres, Elastic fibres, Areolar fibres, Cartilage, Bone Contractile tissue, striated, skeletal, cardiac, non-striated, plain – myoepithelial, General principles of cell physiology, Physiology of skeletal muscle. Blood: Composition, Volume measurement & variations, Plasma proteins –classification & functions, red blood cells –development, morphology & measurements –functions & dysfunctions. White blood cells – development –classification, morphology –functions & dysfunctions Platelets –morphology –development, functions & dysfunctions. Clotting –factors – mechanism –anti- coagulants dysfunctions. Blood grouping –classification – importance in transfusion, Rh factor & incompatibility. Suspension stability, Osmotic stability, Reticulo endothelial system, Spleen, lymphatic tissue, Thymus, bone marrow, immune system, cellular, Humoral, Autoimmune

UNIT-II **10 Hours**

Digestion: General arrangement, Salivary digestion –functions & regulations, Gastric digestion –functions & regulations, Pancreatic digestion –functions & regulations, Intestinal digestion –functions & regulations, Liver & bile- Absorption, Motility, Deglutition, Vomiting, Defecation, Functions of large

intestine, Neurohumoral regulations of alimentary functions. Excretion: Body fluids –distribution, measurement & exchange, Kidney –structure of nephron –mechanism of urine formation –composition of the urine and abnormal constituents –urinary bladder & micturition. Muscular system: types of muscles, muscle contraction, and energy metabolism, Motor units and neuromuscular junctions. Control of movement: spinal reflexes, voluntary movement, and motor pathways, Energy metabolism during exercise and physical activity. Reproduction: Male reproductive system: spermatogenesis, hormonal control, and fertility.

UNIT-III **15 Hours**

Female reproductive system: oogenesis, menstrual cycle, pregnancy, and lactation, Hormonal control of reproductive functions. Respiration: Mechanics of respiration –pulmonary function tests –transport of respiratory gases neural and chemical regulation of respiration –hypoxia, cyanosis, dyspnoea– asphyxia. Circulation: General principles Heart: myocardium – innervation –transmission of cardiac impulse- Events during cardiac cycle – cardiac output. Peripheral circulation: peripheral resistances –arterial blood pressure –measurements –factors regulation variations –capillary circulation – venous circulation. Special circulation: coronary cerebral –miscellaneous. Environmental physiology: Body temperature regulation (including skin Physiology). Exposure to low and high atmospheric pressure

UNIT-IV **10 Hours**

Structure and function of neurons and glial cells, Nervous system organization: central nervous system (CNS) and peripheral nervous system (PNS), Action potentials and nerve impulse transmission, Synaptic transmission: neurotransmitters and synaptic integration. Structure and function of the major endocrine glands, Hormones and their regulation of physiological processes, Neural control vs. endocrine control of body functions. Special senses –(Elementary) Olfaction –Taste –Hearing.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Guyton, A. C., & Hall, J. E. (2016). Textbook of Medical Physiology (13th*

ed.). Saunders.

- *Boron, W. F., &Boulpaep, E. L. (2016). Medical Physiology (3rd ed.). Saunders.*
- *Widmaier, E. P., Raff, H., & Strang, K. T. (2014). Vander's Human Physiology: The Mechanisms of Body Function (13th ed.). McGraw-Hill Education.*
- *Sherwood, L. (2015). Human Physiology: From Cells to Systems (9th ed.). Cengage Learning. Silverthorn, D. U. (2018).*

Course Title: Basic Radiation Physics I	L	T	P	Cr.
Course Code: BRI1102	4	0	0	4

Total Hours 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understanding Radiation Types**:** Students will be able to describe the different types of radiation (alpha, beta, gamma, X-rays, etc.) and their properties.
2. Radiation Interaction with Matter: Students will understand how different types of radiation interact with matter, including processes like ionization, excitation, and scattering.
3. Units of Radiation Measurement**:** Students will be able to define and convert between common radiation units (e.g., Becquerels, Curies, Sieverts, Grays, etc.).
4. Radioactive Decay: Students will be able to explain the principles of radioactive decay and the concepts of half-life, decay constant, and activity.
5. Radiation Detection Methods**:** Students will recognize and describe different radiation detection methods, such as scintillation counters, ionization chambers, and Geiger-Müller counters.

Course Contents

UNIT-I **15 Hours**

Basic concepts: Basic Units, Heat, Acoustics etc. Basic concepts of power, work, force, energy - Einstein's formula - Electronics, Electricity & Magnetism, -electromagnetic waves - Units and measurements - temperature and heat-SI units of above parameters-Atomic structure-Nucleus - Atomic Number, Mass Number electron orbit and energy levels-Periodic table -Isotopes-Isobars Ionization and excitation.

UNIT-II **15 Hours**

Electromagnetic induction: Electric charges-electric induction - electric potential-capacitance and capacitors. Electrical energy and power - unit of current-resistance and Ohm's law - circuit laws - heating effect of current - sources of electrical energy - e.m.f. Magnetism-Magnetic effect of an electric current - applications of magnetic field. Electro-magnetic induction, laws of mutual induction and self induction. Alternating current-transformers

theory and losses - practical aspects-reactance –resonance - impedance and power factors.

UNIT-III **15 Hours**

X-Rays: Electromagnetic waves - quantum theory of radiation - visible light - fluorescence. X-Rays – properties and production of x-rays –- interaction of electrons with target-spectra of x-rays – the quality and intensity of x-rays – the factors such as Filters, applied voltage affecting quality and intensity-Characteristics X-Rays - factors affecting X-Ray-emission spectra - X-ray Quantity and quality – measurements -heel effect - soft and hard X-Rays - added and inherent filtration - reflection and transmission.

UNIT-IV **15 Hours**

X-Ray Circuits: Thermionic diode - X-ray valves and tubes -principle and practical aspects - Semiconductors and semiconductor devices-Introduction, energy bands in solids, the semiconductor types, charge carriers and conductivity, p-n junction diode as rectifier, junction transistor -logic gates. – triode valves – cathode ray oscilloscopes. Self rectifying circuits – Half wave pulsating voltage circuits – full wave pulsating voltage circuits – constant potential circuits – measurement of high voltage – control of KV circuit – MA circuit.-KvP-mA-mAS-HU.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *"Radiology Physics for Medical Students" by William R. Hendee and Charles E. Ritenour*
- *"Essentials of Radiology" by Fred A. Mettler and John R. C. Huda*
- *"Introduction to Radiologic Physics and Radiation Dosimetry" by Frank Herbert Attix*
- *"Radiologic Science for Technologists" by Stewart C. Bushong*
- *"Fundamentals of Radiation Oncology Physics" by Mohammad H. S. A. and Randall L. S.*

Course Title: Introduction to quality and Patient Safety	L	T	P	Cr.
Course Code: BRI1103	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. To understand the basics of emergency care and life support skills and to Manage an emergency including moving a patient
2. To help prevent harm to workers, property, the environment and the general public.
3. To provide a broad understanding of the core subject areas of infection prevention and control.
4. To provide knowledge on the principles of on-site disaster management.
5. To maintain the quality in patient care.

Course Content

UNIT I **10 Hours**

Quality assurance and management – Concepts of Quality of Care, Quality Improvement Approaches, Standards and Norms, Introduction to NABH guidelines. Basics of emergency care and life support skills - Basic life support (BLS), Vital signs and primary assessment, Basic emergency care – first aid and triage, Ventilations including use of bag-valve-masks (BVMs), Choking, rescue breathing methods, One and Two-rescuer CPR

UNIT II **10 Hours**

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

UNIT III **12 Hours**

Infection prevention and control - Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)], Prevention & control of common healthcare associated infections, Components of an effective infection control program, Guidelines (NABH and JCI) for Hospital Infection Control

UNIT IV **13 Hours**

Antibiotic Resistance - History of Antibiotics, How Resistance Happens and Spreads, Types of resistance- Intrinsic, Acquired, Passive, Trends in Drug Resistance, Actions to Fight Resistance, Bacterial persistence, Antibiotic sensitivity, Consequences of antibiotic resistance

Disaster preparedness and management - Fundamentals of emergency management, psychological impact management, Resource management, Preparedness and risk reduction, information management, incident command and institutional mechanisms.

Transactional Mode: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested Reading:

- *Washington Manual of Patient Safety and Quality Improvement Paperback – 2016 by Fondahn (Author)*
- *Understanding Patient Safety, Second Edition by Robert Wachter (Author)*
- *Handbook of Healthcare Quality & Patient Safety Author : Girdhar J Gyani, Alexander Thomas*
- *Researching Patient Safety and Quality in Healthcare: A Nordic Perspective Karina Aase, Lene Schibevaag*
- *Old) Handbook Of Healthcare Quality & Patient Safety by Gyani Girdhar J (Author)*
- *Handbook of Healthcare Quality & Patient Safety by .Gyani G J/Thomas A*

Course Title: Human Rights and Duties	L	T	P	Cr.
Course Code: BRI1104	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Identify and respect the ethical principles related to patient confidentiality and informed consent.
2. Demonstrate awareness of legal frameworks governing medical laboratory practice and blood banking.
3. Recognize and uphold the fundamental human rights of all individuals, regardless of background.
4. Apply principles of non-discrimination and equality in healthcare delivery.
5. Understand and fulfill the professional duties and responsibilities associated with medical laboratory technology.

Course Content

UNIT-I **15 Hours**

Introduction to Human Rights, Definition and historical evolution of human rights, Universal Declaration of Human Rights (UDHR) and its significance, Cultural relativism vs. universalism in human rights discourse, Theories of natural law, social contract, and human dignity, Debates on the universality and cultural specificity of human rights, Relationship between rights and moral duties.

UNIT-II **10 Hours**

International human rights law: treaties, conventions, and customary law, Regional human rights systems (e.g., European Convention on Human Rights, African Charter on Human and Peoples' Rights), National constitutions and domestic protection of human rights, right to life, liberty, and security, Freedom of expression, assembly, and association, right to a fair trial and due process.

UNIT-III **10 Hours**

Right to education, healthcare, and social security, right to work, just and favorable conditions of work, and adequate standard of living, Challenges in realizing economic and social rights, Rights of indigenous peoples, Rights of minorities and marginalized groups, Intersectionality and multiple forms of discrimination.

UNIT-IV **10 Hours**

Human rights violations in armed conflicts and humanitarian crises, Gender equality and women's rights, Rights of refugees, migrants, and stateless persons, Strategies for promoting and defending human rights, Role of civil society organizations, NGOs, and grassroots movements, Ethical dilemmas and challenges in human rights advocacy

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *"The Idea of Human Rights" by Charles R. Beitz*
- *"Just and Unjust Wars" by Michael Walzer*
- *"The Ethics of Authenticity" by Charles Taylor*
- *"Global Justice: A Cosmopolitan Account" by Gillian Brock*

Course Title: General Anatomy Lab	L	T	P	Cr.
Course Code: BRI1105	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Comprehend the normal disposition, inter-relationships, gross, functional and applied anatomy of various structures in the human body.
2. Identify the microscopic structures of various tissues, and organs in the human body and correlate the structure with the functions.
3. Comprehend the basic structure and connections between the various parts of the central nervous system so as to analyse the integrative and regulative functions on the organs and systems.
4. Ability to correctly label bones, muscles, organs, nerves, blood vessels, and other key anatomical components.
5. Ability to interpret the three-dimensional arrangement of body structures through dissection or 3D visualization tools.

Course Contents

List of Practical's / Experiments: **30 Hours**

1. Demonstrate the identification of major bones in the human body.
2. Demonstrate the range of motion and movement types at various joints in the body.
3. Demonstrate the location and function of major muscles in the body.
4. Demonstrate the anatomy and structure of vital organs such as the heart, lungs, liver, kidneys, and intestines.
5. Demonstrate the central and peripheral components of the nervous system.
6. Discuss the characteristics and functions of epithelial, connective, muscular, and nervous tissues.
7. Demonstrate the identification of surface anatomical landmarks on the body.
8. Demonstrate the stages of human embryonic development using models or visual aids.
9. Provide clinical case studies or examples to demonstrate the application of anatomical knowledge in diagnosing and understanding medical conditions**.**

Course Title: General Physiology Lab	L	T	P	Cr.
Course Code: BRI1106	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the normal functioning of various organ systems of the body and their interactions.
2. Elucidate the physiological aspects of normal growth and development.
3. Describe the physiological response and adaptations to environmental stresses.
4. Know the physiological principles underlying pathogenesis of disease
5. Develop a strong understanding of key physiological concepts (e.g., homeostasis, nerve and muscle function, cardiac physiology, respiratory and renal physiology) through hands-on experiments.

Course Contents

List of Practical's / Experiments: 30 Hours

1. Measure blood pressure using a sphygmomanometer and stethoscope.
2. Perform an ECG recording to measure the electrical activity of the heart.
3. Measure lung volumes and capacities using a spirometer
4. Record and interpret brain waves using an EEG machine.
5. Measure muscle strength and fatigue using a handgrip dynamometer or a grip strength measurement device.
6. Measure nerve conduction velocity using surface electrodes and a stimulator
7. Perform blood typing tests to determine ABO and Rh blood groups.
8. Use colorimetric or electrochemical methods to measure electrolyte concentrations (such as sodium, potassium, and calcium) in blood or urine samples.
9. Calculate basal metabolic rate (BMR) using indirect calorimetry, which measures oxygen consumption and carbon dioxide production.
10. Perform urine analysis tests to measure parameters such as pH, specific gravity, protein, glucose, and presence of other substances.

Course Title: Environment Education	L	T	P	Cr.
Course Code: VAC0001	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Grasp the concept of Environmental Science, its components, types of natural resources, their distribution, and usage, with a focus on India.
2. Discuss the factors impacting biodiversity loss and ecosystem degradation in India and the world.
3. An overview of Contemporary Environmental Issues i.e National and Global efforts to address climate change adaptation and mitigation.
4. To understand environmental laws for monitoring pollution.
5. Principles guiding human responsibility toward the environment.

Course Content

Unit-I **6 Hours**

The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment, Indic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. Environmental Ethics and emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and Rio Summit. Natural resources: Definition and Classification. Microbes as a resource; Status and challenges. Environmental impact of over-exploitation, issues and challenges; Water scarcity and Conflicts over water. Mineral resources and their exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. Energy resources: Sources and their classification. Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

Unit-II **6 Hours**

Biodiversity as a natural resource; Levels and types. Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Major ecosystem types in India, their services, classification, significance and characteristics of forests, wetlands, grasslands, agriculture, coastal and marine; Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ approaches; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation. Environmental issues and scales: micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Pollution: Types of Pollution- air, noise, water, soil, thermal, radioactive; municipal solid waste, hazardous waste; transboundary air pollution; acid rain; smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Natural Disasters – Natural and Man-made (Anthropogenic).

Unit-III **8 Hours**

Definition of pollution; Point and non-point sources. Air pollution: sources, Impacts, Primary and Secondary pollutants; Criteria pollutants- carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; National Ambient Air Quality Standards. Water pollution: Sources; River, lake and marine pollution, groundwater pollution, impacts; Water quality parameters and standards. Soil pollution: sources and pollutants. Solid and hazardous waste, its impacts. Noise pollution: Definition, Unit of measurement, sources, noise standards; adverse impacts. Thermal and Radioactive pollution: Sources and impacts. Climate change: natural variations in climate due to greenhouse gas emission- past, present & future. Structure of atmosphere. Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests, natural ecosystems, animal species, agriculture, health,

urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change. Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCs); Climate justice.

Unit-IV **10 Hours**

Introduction to environmental laws and regulation: Article 48A, Article 51A (g) and other environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001 Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme. Bilateral and multilateral agreements on international co-operation of instruments; conventions and protocols; binding and nonbinding measures; Conference of the Parties (COP) Major International Environmental Agreements:- Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention, Minamata Convention, United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution

(Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Production and consumption of Ozone Depleting substances, Green Tribunal; Some landmark Supreme Court judgements Major International organisations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested Readings: -

- *Chahal, M. K. (2024). Environmental Science and Hazards Management (Ecology and Risk Management), ISBN:978-93-6440-586-7.*
- *Baskar, S. and Baskar, R. (2009). Natural Disasters (Earth's Processes & Geological Hazards), ISBN: 978-81-7806-168-9.*
- *Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, Habitat, Ecology, and Sustainability, Intech Open, London. 10.5772/*
- *Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press.*
- *Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.*
- *Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238.*
- *William P.Cunningham and Mary A. (2015) Cunningham Environmental Science: A Global Concern, Publisher (Mc-Graw Hill, USA)*
- *Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/ standards/*
- *Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.*
- *Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions &Programmes. https://moef.gov.in/wp- content/uploads/2020/02/ convention-V-16-CURVE-web.pdf*

Course Title: English for profession	L	T	P	Cr.
Course Code: BRI1107	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Demonstrate effective patient communication.
2. Produce clear and concise medical documentation.
3. Interpret and analyze medical texts and research.
4. Participate confidently in professional discussions and presentations.
5. Students will be able to understand and use professional vocabulary and terminology relevant to their chosen field, including industry-specific jargon.

Course Contents

UNIT I **7 Hours**

Etiquette – Telephone, Table (Different ways of enhancing oneself)

1. Parts of Speech Tens Vocabulary.
2. Synonyms.
3. Antonyms.
4. One word substitute.
5. Homophones.
6. Homonyms.

UNIT II **7 Hours**

Composition

1. Orientation to different types of letters – (Social, business letter, applying for a job, for higher studies, preparing curriculum vitae, subscribing to a journal, letters to the Editor).
2. Essay writing – Descriptive, Narrative and Reflective.
3. Précis or Summary writing
4. Report writing (with special stress on scientific/technical reports, preparing field/observation report).

UNIT III **7 Hours**

Practical/ Spoken English

- Front Desk management, fixing appointments, getting information –

Managing medical representatives, able to answer FAQs, lab reports writing, telephoning in a hospital: the object is to practice influent conversation

1. JAM session.
2. Conversation.
3. Group discussion.
4. Role-plays.
5. Conversation. Group discussion.
6. Presentation.
7. Role plays.

UNIT IV **9 Hours**

Grammar

1. Narration.
2. Voice change (Use of passive voice particularly in scientific and official writing).
3. Use of articles and preposition.
4. Figures of speech.
5. Vocabulary
   - The language of Doctor and Patient.
   - General description and medical description.
   - Medical terminology – roots.
   - Prefixes and suffixes.
   - Medical abbreviations.
6. Punctuation.
7. Common errors in English

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Loveleen Kaur, 'Communication Skills' Satya Prakashan Publication.*
- *Narinder Kumar Bodhraj, 'Business Communication', Kalyani Publishers, 2011.*
- *S.P. Dhanavel, 'English & communication Skills for the Students of*

Science & Engineering' Orient blackswan publication, 2009.

- *Indrajit Bhattacharya, 'An Approach to Communication Skills'.*
- *Chissie Wright, 'Handbook of Practical Communication Skills'*

2nd SEMESTER

Course Title: Radiological and imaging equipment's	L	T	P	Cr.
Course Code: BRI2150	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the Basic Principles of Imaging Equipment – Explain the physics and technology behind radiological imaging modalities.
2. Describe Different Types of Imaging Equipment – Identify and differentiate between X-ray, CT, MRI, ultrasound, fluoroscopy, and nuclear medicine systems.
3. Explain the Components and Functioning of Equipment – Understand the working principles of X-ray tubes, detectors, generators, and image processing systems.
4. Discuss Image Acquisition and Processing – Explain how images are captured, reconstructed, and processed in digital and analog imaging systems.
5. Evaluate Image Quality Parameters – Assess factors affecting image quality, including resolution, contrast, noise, and artifacts.

Course Contents

UNIT-I **10 Hours**

Historical aspects, early X-ray tubes General features and Construction of X-ray tubes Fixed anode x ray tube, Rotating anode x ray tube - speed of anode rotation, angle of anode inclination (target angle), rotating tubes-line focus principle, dual focus and practical consideration in choice of focus, Focal spotsizes, anode heel effect Effect of variation of anode voltage and filament temperature; continuous and characteristics spectrum of x -rays, inherent filter and added filter, their effect on quality of the spectrum. Quality and intensity of x-rays, factors influencing them, Tube voltage, current, space charge, X-ray production efficiency Tube insert and housing, Rating of X-ray tubes Grid controlled X-ray tubes Methods of cooling the anode, rating chart and cooling chart, Methods of heat dissipation in x ray tube Common tube faults Advances in X-ray tubes and Modern X-ray tubes Portable and mobile X-ray units

UNIT-II **15 Hours**

X-ray generator circuits: Generator for x-ray machines, Rectification, Types of rectifier valve and solid state, Self-rectified high-tension circuit, Half wave, Four valve full wave, Three phase, Full wave rectified circuit, High tension Generators, Voltage wave forms in high tension generators, Automatically programmed generators and modular Generators. The high-tension transformer, The control of kilovoltage , Kilovoltage indication, The filament circuit and control of tube current, Milliamperes indications, Main voltage compensation, Mains supply and x ray set, Switching systems, Timing system, Exposure switching and its radiographic application. Circuit breakers, Interlocking circuit, machine overload protection Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement. Other scatter reduction methods, Air gap technique. CR and DR system Computed radiography: its principle, physics & equipment. Digital Radiography. Flat panel digital fluoroscopy and radiography system, advantages, disadvantages and applications. Stich radiography, Picture archiving and communication system (PACS)

UNIT-III **10 Hours**

Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, Structure of fluorescent screen, The fluoroscopic image, The fluoroscopic table, Spot film devices andexplorators, Protective measures and physiology of vision, Image quality. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualizing intensified image, basic principles of closed circuit television camera, picture tube, CCD. Automatic brightness control, automatic exposure control, Cine radiographic cameras, pg. 9 Remote control table. 123Mammography equipment Equipment for conventional mammography and Digital Mammography, principles and advances in mammography

UNIT-IV **10 Hours**

Angiography equipments Rapid serial radiography, Rapid film changer, Rapid cassette changer, Angiographic tables, Contrast medium injection devices Digital subtraction angiography: Equipment, principle, advancements. Tomography: Body section radiography, basic principle and equipment, multi section tomography, Transverse axial tomography, various types of tomographic movements, Tomosynthesis, applications in present time DEXA equipment- principle, advancements and applications. Basic principles used in nuclear medicine imaging (radiotracers, SPECT cameras)

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *"The Essential Physics of Medical Imaging" – Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt, John M. Boone*
- *"Christensen's Physics of Diagnostic Radiology" – Thomas S. Curry, James E. Dowdey, Robert C. Murry Jr.*
- *"Principles of Radiographic Imaging: An Art and A Science" – Richard R. Carlton, Arlene M. Adler*
- *"Medical Imaging Physics" – William R. Hendee, E. Russell Ritenour*
- *"Nuclear Medicine and PET/CT: Technology and Techniques" – Paul E. Christian, Kristen M. Waterstram-Rich*

Course Title: Basic Radiation Physics II	L	T	P	Cr.
Course Code: BRI2151	4	0	0	4

Total Hours 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand Atomic Structure – Explain the basic structure of an atom, including protons, neutrons, and electrons, and their roles in radiation physics.
2. Describe Radioactive Decay – Identify different types of radioactive decay (alpha, beta, gamma) and their properties.
3. Explain Radiation Types – Differentiate between ionizing and non-ionizing radiation and their interactions with matter.
4. Understand X-ray Production – Describe how X-rays are generated, including Bremsstrahlung and characteristic radiation.
5. Discuss Radiation Units and Measurement – Define key radiation units (Gray, Sievert, Becquerel, Curie) and explain dosimetry principles.

Course Contents

UNIT-I **15 Hours**

Radioactivity: Natural and artificial radioactivity-alpha decay-beta decay and spectra – gamma emission-positron decay electron capture and internal conversion-Exponential decay-Half life-Unit of activity-specific activity. Nuclear Fission-Nuclear reactor. Radiation sources-Natural and artificial production of radio isotopes-reactor produced isotopes-Fission products-Gamma ray source for Medical uses.

UNIT-II **15 Hours**

Interaction of X-and Gamma rays: Attenuation of X-ray or Gamma rays-absorption and scattering-half value layer-coherent scattering-Photo electric absorption-compton scattering-pair production and photoelectric disintegration. X-Ray transmission through medium-linear and mass attenuation coefficients. HVT - TVT and interaction of charged particle and neutrons with matter. Interaction of X-and Gamma rays in body-fat-soft-tissue-bone-contrast medium-Total attenuation coefficient. Relative important of different types of interactions.

UNIT-III **15 Hours**

X-Ray generators and circuits-Filament current and voltage, X-Ray circuits - primary circuit auto transformer-switch and timers- principle of automatic exposure control and practical operation - filament circuit -high voltage circuits - half wave & full wave rectification -three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits- falling load generators-capacitors discharge and grid control systems.

UNIT-IV **15 Hours**

X-Ray Grids /Bucky: Scattered Radiation -Significance of scatter – Beam limiting devices.-Grid principle and structure – Types of Grids - vertical bucky- versatile bucky -Stationary grid, parallel grid, focused grid – crossed grid, moving grid – Potter Bucky Diaphragm- Control of scattered radiation and grids/Bucky - Methods of minimizing formation of scatter radiation, types of grids and grid ratio- use of cones – diaphragm/ light beam devices - effectiveness of collimation - limitations of the primary beam/the light beam diaphargm -Effects of scatter radiation on radiograph image quality, patient dose and occupational exposure. X-Ray Cassettes & Intensifying screens: Fluorescence – constituents of intensifying screens – types of screens-intensification factors-speed of screen-screen unsharpness. Cassette-construction types of cassettes- use of fluorescent screen in radiology, effect of screen in reduction of patient dose.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *"Radiologic Science for Technologists: Physics, Biology, and Protection" – Stewart C. Bushong*
- *"The Essential Physics of Medical Imaging" – Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt, John M. Boone*
- *"Introduction to Radiological Physics and Radiation Dosimetry" – Frank Herbert Attix*
- *"Physics for Radiation Protection" – James E. Martin*

Course Title: Computer Application	L	T	P	Cr.
Course Code: BRI2152	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Demonstrate proficiency in utilizing computer software for laboratory data management.
2. Apply computer skills to analyze and interpret laboratory results.
3. Utilize electronic resources for accessing and managing medical information.
4. Implement cyber security best practices in a laboratory setting.
5. Effectively communicate laboratory data using computer-generated reports.

Course content

Unit-I **14 Hours**

Introduction to Various Computer Parts: Input output devices: input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices); output devices (monitors, pointers, plotters, screen image projector, voice response systems). Processor and memory: The Central Processing Unit (CPU), main memory. Storage Devices: sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.

Unit-II **12 Hours**

MS- Word, Excel, Power Point: Components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge; worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs; creation and manipulation presentation, formatting and enhancing text, slide with graphs.

Unit-III **10 Hours**

Introduction of Windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).

Unit-IV **9 Hours**

Application of Computers in Various Fields: Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.

Transactional Mode: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested Reading:

- *Sunita Goel, 'Computer Fundamentals', Pearson Publication.*
- *Anupam Jain and Avneet Mehra, 'Computer Fundamental MS Office: Including Internet & Web Technology'.*
- *P.K. Sinha, 'Introduction to Computers' BPB Publications.*
- *Raymond Greenlaw, 'Fundamentals of the Internet & the World Wide Web'.*
- *Sunjay Saxena, 'Introduction to Computers and MS Office'*

Course Title: Nutrition	L	T	P	Cr.
Course Code: BRI2153	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the basic principles of nutrition and their relevance to health.
2. Identify essential nutrients and their functions.
3. Apply dietary guidelines to promote health and prevent disease.
4. Recognize the role of nutrition in various health conditions.
5. Provide basic nutritional counseling and education.

Course Content

Unit I **10 Hours**

Fundamentals of Nutrition

- Introduction to nutrition: Definition, scope, and importance.
- Essential nutrients: Macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins, minerals).
- Digestion, absorption, and metabolism of nutrients.
- Energy balance and requirements.
- Food groups and dietary guidelines.

Unit II **10 Hours**

Nutritional Assessment and Planning

- Methods of nutritional assessment: Anthropometric measurements, biochemical assessments, clinical assessments, and dietary assessments.
- Dietary planning and meal preparation.
- Nutritional needs across the lifespan: Infants, children, adolescents, adults, and elderly.
- Special dietary considerations: Vegetarian, vegan, and cultural diets.

Unit III **12 Hours**

Nutrition in Health and Disease

- Role of nutrition in disease prevention and management.
- Nutrition-related disorders: Obesity, malnutrition, diabetes, cardiovascular diseases, and cancer.
- Enteral and parenteral nutrition.
- Food safety and hygiene.
- Food allergies and intolerances.

Unit IV **13 Hours**

Nutritional Counseling and Education

- Principles of nutritional counseling.
- Effective communication and patient education.
- Promoting healthy eating habits.
- Addressing common nutritional misconceptions.
- Community nutrition and public health.

Transactional Mode: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested Reading:

- *Whitney, E., & Rolfes, S. R. (2019). Understanding nutrition. Cengage Learning.*
- *Srilakshmi, B. (2014). Dietetics. New Age International.*
- *Wardlaw, G. M., & Smith, A. M. (2018). Contemporary nutrition. McGraw-Hill Education.*

Course Title: Radiological And Imaging Equipment's Lab	L	T	P	Cr.
Course Code: BRI2154	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the Basic Components of Imaging Equipment – Identify and describe the key parts of X-ray, CT, MRI, ultrasound, and nuclear medicine systems.
2. Operate Radiographic and Fluoroscopic Systems – Demonstrate proper use of radiography and fluoroscopy machines, including exposure settings and image acquisition.
3. Perform Quality Control (QC) Tests on Imaging Equipment – Conduct routine QC procedures to ensure optimal performance and patient safety.
4. Analyze Image Quality Parameters – Evaluate resolution, contrast, noise, and artifacts in radiographic images.
5. Understand Radiation Dose Optimization – Apply ALARA principles to minimize radiation exposure to patients and staff while maintaining image quality.

Course Contents

List of Practical's / Experiments: **30 Hours**

1. Structure and function of X-ray tubes and generators
2. Components and working principles of imaging equipment
3. Introduction to gamma cameras, PET/CT scanners, and SPECT systems'
4. Overview of X-ray machine components (tube, generator, collimator, detector)
5. Principles of X-ray production (Bremsstrahlung & characteristic radiation)
6. Fluoroscopy: Equipment setup, radiation dose control, image intensifiers
7. Mobile and portable X-ray machines: Operational differences and limitations

Course Title: Human Values and Professional Ethics	L	T	P	Cr.
Course Code: VAC0002	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the essence of Indian ethos, cultural values and ethical principles derived from scriptures, integrating self-exploration with scientific inquiry.
2. Analyze human values, self-awareness and ethical decision-making by distinguishing between perspectives, ideologies and universal moral principles.
3. Evaluate constitutional values, global responsibilities and the role of ethics in citizenship while promoting inclusivity and social welfare.
4. Develop essential life skills, stress management techniques and holistic well-being through mindfulness, self-discipline and personality development.
5. Develop ethical decision-making skills based on core values such as integrity, honesty, and empathy.

Course Content

Unit-I **7 Hours**

Meaning of ethos and cultural essence of India, Scriptures as the base of the Indian Knowledge System (IKS), Integrating the two methodologies: interiorization process for self-exploration and exterior scientifc pursuit for the prosperity of world, The Law of Karma and Nishkama Karma (The Law of action and selfless action), Practical: Five hours of Yoga practice per week, Ethics through Music and Indian Poetry, Community Engagement

Unit-II **8 Hours**

Knowing the Self and the universal values that we stand for. This is self-enquiry & self-discovery, Background conversations and deep listening, recognizing the assumptions that we make, the biases we have and the implications for ethical action. Self-identity: distinguishing and embracing oneself (and others) four profiles (inner potential, social, professional, personality), Distinguish ideology, perspectives beliefs from embodying

values. Practical: Self-discovery, self-enquiry and Mindfulness, Yama & Niyama of Ashthang Yoga

Unit-III **7 Hours**

Values embedded in the Preamble of the Indian Constitution, Integration of Human Rights and duties. Principles and responsibilities: as citizens of India, towards global environment, Loksangraha and VasudhaivaKutumbakam, Conscious Full Spectrum Response model. Distinguishing judgement from discernment, Practical: Development of concentration among students through music, fine arts, mathematics, sports, yoga and mindfulness

Unit-IV **8 Hours**

The three gunas (qualities of sattva—purity and harmony, rajas —activity and passion, tamas —darkness and chaos), the four antah-karanas (inner instruments) and panch kosha (five sheaths), Stress management, Oneness, non-duality and equanimity, Physical, mental, social and spiritual well-being. Practical: Talks on importance of the Ayurvedic concept of well-being and nutrition, sports activities.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Mahadevan, B., Bhat, V.R. and Nagendra, P.R.N. 2022. Introduction to Indian Knowledge System. Delhi: PHI.*
- *Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.*
- *Kashyap, Subhash C. 2019. Constitution of India. A handbook for students. New Delhi: National Book Trust.*
- *Dr. Awadesh Pradhan, Mahamanake Vichara". (B.H.U., Vanarasi 2007)*
- *Harold Koontz & Heinz Weihrich, Essentials of Management, Tata McGraw Hill. Lama, D. 2012. Beyond Religion: Ethics for a Whole World. India: Harper Collins.*

Course Title: Communication and Presentation Skills	L	T	P	Cr.
Course Code: BRI2155	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Demonstrate clear and effective verbal and non-verbal communication.
2. Construct and deliver organized and engaging presentations.
3. Apply active listening and interpersonal skills in professional settings.
4. Produce accurate and professional written communication.
5. Understand the impact of written tone and etiquette in professional communication.

Course Content

UNIT I **7 Hours**

1) Communication: Definition, meaning.
2) Importance of Communication in Health
3) Functions of Communication.

UNIT II **7 Hours**

1) Communication channels - Definition dimension and classification, selection of communication channels.
2) Feedback in communication – Feedback p
3) rocess, effect of feedback in health communication.
4) Problems in communication - various types of problems.

UNIT III **7 Hours**

1) Mass communication e.g. Radio, television, traditional systems like nukkadnatak, drama, puppet show
2) Inter personal communication: Lecture method (IPC).

UNIT IV **9 Hours**

1) Intrapersonal communication like demonstration, group discussions, seminars symposium, workshop, conference, CME, communication network
2) Various ways of creating awareness about health-related issues

3) Counseling, pretest counseling, posttest counseling.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Loveleen Kaur, 'Communication Skills' Satya Prakashan Publication.*
- *Narinder Kumar Bodhraj, 'Business Communication', Kalyani Publishers, 2011.*
- *S.P. Dhanavel, 'English & communication Skills for the Students of Science & Engineering' Orient blackswan publication, 2009.*
- *Indrajit Bhattacharya, 'An Approach to Communication Skills'.*
- *Chissie Wright, 'Handbook of Practical Communication Skills'.*

Course Title: Radiation Protection	L	T	P	Cr.
Course Code: BRI2156	4	0	0	4

Total Hours 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the units and measurements used in radiation physics, including exposure, absorbed dose, dose equivalent, and activity, and their significance in radiological protection.
2. Describe the interactions of ionizing radiation with matter, including the photoelectric effect, Compton scattering, and pair production, and how these interactions affect radiation dose.
3. Identify and categorize sources of ionizing radiation, both natural (e.g., background radiation) and artificial (e.g., medical X-ray machines, radioactive isotopes).
4. Familiarize with international and national radiation safety standards, guidelines, and regulations governing the use of ionizing radiation.

Course Contents

UNIT-I **15 Hours**

Radiation Quantities and Units Radiation- Radioactivity- Sources of radiation - natural radioactive sources -cosmic rays-terrestrial radiation - man made radiation sources. Units of radiation - Quality factor - Flux-Fluence-Kerma Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits - Dose limits to public.

UNIT-II **15 Hours**

Biological Effects of radiation Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell - Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary effects- stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radio-sensitivity. Biological effects of nonionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.

UNIT-III **15 Hours**

Radiation detection and Measurements: Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers – proportional counters- G.M counters scintillation detectors – liquid semiconductor detectors – Gamma ray spectrometer. Measuring systems – free air ionization chamber – thimble ion chamber – condenser chamber – Victorian electrometer – secondary standard dosimeters – film dosimeter – chemical dosimeter- thermos luminescent Dosimeter. - Pocket dosimeter-Radiation survey meter- wide range survey meter -zone monitor-contamination monitor -their principle-function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement.

UNIT-IV **15 Hours**

Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey –ALARA- personnel dosimeters (TLD and film batches)-occupational exposure. Layout for radiological rooms.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- Statkiewicz Sherer MA, Visconti PJ, Ritenour ER, Haynes KW. *Radiation Protection in Medical Radiography*. 9th ed. St. Louis: Elsevier; 2022.
- Martin A, Harbison SA, Beach JR, Cole P. *An Introduction to Radiation Protection*. 7th ed. Boca Raton: CRC Press; 2019.
- Jayaraman S, Lanzl LH. *Clinical Radiotherapy Physics*. New York: Advanced Medical Publishing; 2008.
- Hendee WR, Ibbott GS, Ritenour ER. *Radiation Protection in Medical Imaging and Radiation Oncology*. 3rd ed. Philadelphia: Wolters Kluwer; 2019.
- International Commission on Radiological Protection.*Radiation Protection Recommendations as Applied to the Disposal of Long-lived Solid Radioactive Waste*. ICRP Publication 81. Annals of the ICRP. 2000;30(1):1-4.

Course Title: Biomedical waste Management	L	T	P	Cr.
Course Code: BRI2157	4	0	0	4

Total Hours: 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Comprehend the fundamental properties of ionizing radiation, including the differences between alpha, beta, gamma, and X-ray radiation.
2. Explain the units and measurements used in radiation physics, including concepts like exposure, absorbed dose, dose equivalent, and activity.
3. Explore various waste management methods, including segregation, storage, transportation, treatment, and disposal.
4. Gain proficiency in the use of various radiation detection instruments and techniques, such as Geiger-Muller counters, scintillation detectors, and dosimeters.

Course Contents

UNIT-I **15 Hours**

Introduction to Biomedical Waste Management Definition and classification of biomedical waste Historical overview and importance of biomedical waste management Legal and regulatory framework Types and Sources of Biomedical Waste Classification of biomedical waste based on infectious, hazardous, and general waste.

UNIT-II **15 Hours**

Health Hazards and Risks Potential and hazards associated with improper biomedical waste management, Infection control and prevention measures Waste Segregation and Collection Segregation guidelines and color codingCollection methods and container types

UNIT-III **15 Hours**

Waste Disposal and Environmental Impact Landfilling, landfill requirements, and considerations Environmental consequences of improper waste disposal Waste-to-energy and recycling options Storage and Transportation

Storagerequirements and guidelines. Transportation regulations and safety measures Treatment Technologies Overview of treatment methods: autoclaving, incineration, chemical disinfection, etc. Emerging technologies and advancements in waste treatment

UNIT-IV **15 Hours**

Waste Management Planning and Implementation Developing waste management plans for healthcare facilities Staff training and awareness programs monitoring and auditing waste management practices,Biomedical Waste Management Rules 2016.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Prüss-Üstün, A., &Rapiti, E. (2008). Safe management of wastes from health-care activities. World Health Organization.*
- *Srivastava, A., & Kaushal, R. K. (2020). Biomedical waste management during COVID-19 pandemic: A review. Environmental Sustainability and Resource Management, 2(1), 53-61.*
- *Rao, P. V., & Patnaik, S. K. (2016). Biomedical waste management: An exploratory study. International Journal of Environmental Science and Technology, 13(7), 1607-161*
- *Bhattacharya, S., Biswas, S., Das, D., & Nair, P. (2019). Biomedical waste management in India: Critical appraisal. Journal of International Environmental Application & Science, 14(2), 91-97.*

3rd SEMESTER

Course Title: Clinical Radiography Positioning-I	L	T	P	Cr.
Course Code: BRI3200	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Demonstrate Proper Patient Positioning – Accurately position patients for common radiographic examinations to ensure optimal image quality.
2. Understand Radiographic Anatomy – Identify key anatomical landmarks used in positioning for different body regions.
3. Apply Standard Positioning Techniques – Perform routine radiographic projections for the skull, spine, chest, abdomen, and extremities.
4. Ensure Radiation Safety – Apply radiation protection principles, including collimation, shielding, and minimizing patient dose.
5. Evaluate Radiographic Image Quality – Assess radiographs for correct positioning, exposure, and diagnostic value.

Course Content

UNIT-I **10 Hours**

Body planes and movements. Lungs and Mediastinum: Technique for routine projections (chest X-ray PA view, lateral view), Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated postero-anterior projection. - Expiration technique. - Technique for pleural fluid levels and adhesions.

UNIT-II **13 Hours**

Whole upper limb: Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio ulnar joints and humerus supplementary techniques for the above. e.g. Carpal tunnel view, ulnar groove, head of the radius, supracondylar projections

UNIT-III **13 Hours**

Whole lower limb: Technique for foot, toes, great toe, tarsal bones, calcaneum, ankle joint, lower leg, knee, patella & femur. Supplementary techniques: Stress view for torn ligaments, • Subtalar joint and talo-

calcaneal joint. • Inter condylar projection of the knee. • Tibial tubercle. • Length measurement technique.

UNIT-IV **09 Hours**

Shoulder girdle Technique for shoulder joint, scapular, clavicle, acromioclavicular joints, sternum, ribs,sterno-clavicular joint. Supplementary projections and techniques • Recurrent dislocation of shoulder. • Traumatic dislocation of shoulder. • Cervical ribs

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Bontrager KW, Lampignano JP. Textbook of radiographic positioning and related anatomy. 9th ed. St. Louis, MO: Elsevier; 2018.*
- *Ballinger PW, Frank ED. Merrill's atlas of radiographic positioning and procedures. 14th ed. St. Louis, MO: Elsevier; 2019.*
- *Mc Quillen Martensen K. Radiographic image analysis. 5th ed. St. Louis, MO: Elsevier; 2020.*
- *Long BW, Rollins JH, Smith BJ. Merrill's pocket guide to radiography. 14th ed. St. Louis, MO: Elsevier; 2018.*
- *Bushong SC. Radiologic science for technologists: physics, biology, and protection. 12th ed. St. Louis, MO: Elsevier; 2020.*

Course Title: Microbiology and Immunology	L	T	P	Cr.
Course Code: BRI3201	4	0	0	4

Total Hours 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the classification and structure of microorganisms (bacteria, viruses, fungi, parasites).
2. Describe microbial growth, metabolism, and genetics.
3. Understand microbial pathogenesis and mechanisms of disease causation.
4. Identify methods of sterilization, disinfection, and antimicrobial agents.
5. Identify medically important bacteria and their associated diseases.

Course Contents

UNIT-I **15 Hours**

Introduction to Microbiology & Immunology

- Overview of microorganisms (bacteria, viruses, fungi, parasites)
- Basic immunological concepts (innate and adaptive immunity)

Microbial Pathogenesis & Infection Control

- Mechanisms of infection and host-pathogen interactions
- Hospital-acquired infections (HAIs) and sterilization techniques

Imaging of Infectious Diseases

- Radiological manifestations of bacterial, viral, and fungal infections
- Role of imaging in detecting sepsis and inflammatory conditions

UNIT-II **15 Hours**

Bacterial Infections in Radiology

- Tuberculosis: Imaging findings (CXR, CT, MRI)
- Pneumonia: Bacterial vs. viral patterns on imaging
- Osteomyelitis and septic arthritis: Role of MRI and nuclear imaging

Viral Infections in Radiology

- COVID-19: CT scan findings and diagnostic role
- Hepatitis and its effects on liver imaging
- Neurotropic viruses: MRI in encephalitis and viral meningitis

UNIT-III **15 Hours**

Autoimmune Diseases and Imaging

- Rheumatoid arthritis, lupus, and scleroderma: MSK imaging findings
- Vasculitis and its manifestations on angiography and MRI

Immunodeficiency and Radiology

- HIV/AIDS-related infections: CNS and pulmonary imaging
- Post-transplant infections and radiological diagnosis

Inflammatory Disorders and Radiology

- Sarcoidosis: HRCT and PET-CT findings
- Inflammatory bowel diseases (IBD): MRI and CT applications

UNIT-IV **15 Hours**

Nuclear Medicine in Infection & Inflammation

- PET-CT in detecting occult infections
- Role of Gallium-67 and labeled WBC scans

Interventional Radiology in Infectious & Immune Conditions

- Image-guided biopsy in infectious diseases
- Drainage procedures for abscesses and infected collections

Emerging Trends & AI in Infectious Disease Radiology

- AI-assisted diagnosis of infections
- Radiomics and big data in microbiology-related imaging

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *"Medical Microbiology"byMurray, Rosenthal, and Pfaller*
- *"Jawetz, Melnick, & Adelberg's Medical Microbiology"byCarroll, Hobden, and Miller(McGraw Hill)*
- *"Schaechter's Mechanisms of Microbial Disease"byEngleberg, DiRita, and Dermody(LWW)*
- *"Kuby Immunology"byOwen, Punt, and Stranford (W. H. Freeman)*
- *"Roitt's Essential Immunology"byDelves, Martin, Burton, and Roitt(Wiley-Blackwell)*

Course Title: First Aid	L	T	P	Cr.
Course Code: BRI3202	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Provide appropriate first Aid form in or injuries including small cuts, grazes, bruises etc.
2. Assess situations and circumstances in order to provide First Aid safely, promptly and effectively in arrange of emergencies.
3. Manage organizations, records related to patients and departmental statistics.
4. Identify signs and symptoms of common medical emergencies, injuries, and accidents.
5. Learners will understand the importance of clear communication, including how to give concise instructions, alert emergency services, and provide relevant information during a crisis.

Course Contents

UNIT-I **15 Hours**

First aid: Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus; drug reactions; prophy lactic measures; administration of oxygen; electric shock; burns; scalds; haemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons.

UNIT-II **10 Hours**

Infection: Bacteria, their nature and appearance; spread of infections; auto- infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; Asepsis and antisepsis. Universal precautions, hospital acquired infections-HIV, HepatitisB, C, and MRSA etc.

UNIT-III **10 Hours**

Principles of Asepsis: Sterilization- methods of sterilization; use of

central sterile supply department; care of identification of instruments, surgical dressings in common use, including filament swabs, elementary operating theatre procedure; setting of trays and trolleys

UNIT-IV **10 Hours**

Departmental procedures: Department staffing and organizations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested Readings:

- *Curry,T.S.,Dowdey,J.E.,&Murray,R.C.(1990).Christe nsen'sphysicsof diagnostic radiology. Lippincott Williams & Wilkins.*
- *Podgoršak, E. B. (2006). Radiation physics for medical physicists (Vol. 1). Berlin: Springer.*
- *Weishaupt, D., Köchli, V. D., &Marincek, B. (2008). How does MRI work?:an introduction to the physics and function of magnetic resonance imaging. Springer Science & Business Media.*

Course Title: Disaster Management	L	T	P	Cr.
Course Code: BRI3203	3	0	0	3

Total Hours 45 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the principles of disaster management.
2. Identify and classify different types of disasters.
3. Apply emergency medical response protocols in disaster situations.
4. Participate in disaster preparedness and mitigation activities.
5. Communicate effectively during disaster response.

Course Contents

Unit I **10 Hours**

Introduction to Disaster Management

- Definitions and concepts of disaster, hazard, risk, and vulnerability.
- Types of disasters: Natural (earthquakes, floods, cyclones) and man-made (chemical spills, industrial accidents).
- The disaster management cycle: Mitigation, preparedness, response, and recovery.
- National and international disaster management frameworks.
- Role of paramedical professionals in disaster management.

Unit II **10 Hours**

Disaster Preparedness and Mitigation

- Risk assessment and vulnerability analysis.
- Developing disaster management plans.
- Early warning systems and communication strategies.
- Community-based disaster preparedness.
- First aid and basic life support training.
- Resource management and logistics.

Unit III **10 Hours**

Emergency Medical Response in Disasters

- Triage and casualty management.
- Management of trauma and injuries.
- Infection control and sanitation.
- Psychological first aid.
- Mass casualty incidents and field hospitals.
- Transportation of injured people.

Unit IV **10 Hours**

Post-Disaster Recovery and Rehabilitation

- Needs assessment and damage evaluation.
- Rehabilitation and reconstruction.
- Mental health and psychosocial support.
- Disease surveillance and prevention.
- Ethical considerations in disaster management.
- Legal aspects of disaster management.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question Answer

Recommended Textbooks:

- *Alexander, D. (2016). Natural disasters. Routledge.*
- *Haddow, G. D., Bullock, J. A., & Coppola, D. P. (2017). Introduction to emergency management. Butterworth-Heinemann.*
- *Carter, W.N. (1991). Disaster Management: A Disaster Manager's Handbook. Asian Development Bank.*
- *WHO, (Various publications) World Health Organization emergency and disaster related publications.*

Course Title: Clinical Radiography Positioning-I Lab	L	T	P	Cr.
Course Code: BRI3204	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Accurately position patients for routine radiographic projections of the chest, upper limb, lower limb, and shoulder girdle.
2. Ensure proper alignment of anatomical landmarks for optimal image quality.
3. Utilize breathing techniques (e.g., expiration technique for pneumothorax, inspiration for lung expansion).
4. Execute specialized projections (e.g., lordotic view for lung apices, intercondylar knee view, carpal tunnel view).
5. Adapt techniques for trauma cases, mobility impairments, and suspected fractures.

Course Contents

List of Practical's / Experiments **30 HOURS**

- Chest Radiography
- Upper Limb Radiography
- Lower Limb Radiography
- Shoulder Girdle & Thoracic Cage Radiography

Course Title: English for Clinical Language	L	T	P	Cr.
Course Code: BRI3205	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand and utilize medical terminology accurately.
2. Communicate effectively with patients and healthcare professionals.
3. Write clear and concise medical reports and documentation.
4. Demonstrate professional communication skills in healthcare settings.
5. Students will acquire the necessary vocabulary related to medical procedures, diagnoses, treatments, and anatomy, enabling them to confidently understand and use clinical terms in both verbal and written communication.

Course Content

UNIT I **7 Hours**

Foundations of Medical Terminology

1) Introduction to medical terminology: Roots, prefixes, suffixes.
2) Anatomical and physiological terms.
3) Terms related to common diseases and conditions.
4) Understanding and using medical abbreviations.
5) Pronunciation and spelling of medical terms.

UNIT II **7 Hours**

Patient Communication and Interaction

1) Effective communication techniques with patients.
2) Taking patient history and conducting interviews.
3) Explaining medical procedures and treatments.
4) Handling difficult or sensitive conversations.
5) Cultural sensitivity in patient communication.

UNIT III **7 Hours**

Medical Documentation and Report Writing

1) Principles of medical documentation.

2) Writing patient reports and case studies.
3) Documenting medical procedures and observations.
4) Using medical charts and electronic health records (EHR).
5) Grammar and style for medical writing.

UNIT IV **9 Hours**

Professional Communication in Healthcare

1) Communication with other healthcare professionals.
2) Presenting medical information in meetings and conferences.
3) Using professional email and correspondence.
4) Ethical considerations in medical communication.
5) Developing presentation skills.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Young, B. A. (2018). Medical terminology: An illustrated guide. F.A. Davis.*
- *Rice, R. (2017). Medical terminology with human anatomy. Pearson.*
- *Boothman, R. C. (2013). How to Connect in Business in 90 Seconds or Less. Pearson.*
- *Geffner, D. (2018). The Skilled Helper: A Problem-Management and Opportunity-Development Approach to Helping. Cengage Learning.*

Course Title: Hospital Infection Control and Preventions	L	T	P	Cr.
Course Code: VAC0003	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Define infection control and explain its importance in the hospital setting.
2. Explain the nature and characteristics of pathogens (bacteria, viruses, fungi, and parasites).
3. Understand the role of surveillance in preventing infections.
4. Understand the unique infection risks posed to vulnerable patient populations (e.g., immunocompromised patients).
5. Participants will learn to identify common healthcare-associated infections, their symptoms, and risk factors, and understand how they are transmitted within hospital environments.

Course Content

UNIT-I **8 Hours**

Introduction to Infection Control

- Definition and importance of infection control in hospitals
- Types of infections in healthcare settings (e.g., nosocomial infections, cross-contamination)
- Impact of hospital-acquired infections (HAIs) on patient outcomes, healthcare workers, and hospital operations
- Legal and ethical considerations in infection control

Key Concepts and Terminologies

- Infections vs. Colonization
- Modes of Transmission (contact, droplet, airborne, etc.)
- Reservoirs, portals of entry and exit, and susceptible hosts
- Infection Control principles (Isolation, Standard Precautions, etc.)

Microbial Pathogens in Healthcare Settings

- Bacteria, viruses, fungi, and parasites commonly found in healthcare settings
- Antibiotic-resistant pathogens (e.g., MRSA, C. difficile, CRE, etc.)

- Understanding pathogenicity and virulence

UNIT-II **8 Hours**

Standard Precautions

- Hand hygiene (indications, techniques, alcohol-based hand rubs, and soap-and-water washing)
- Personal Protective Equipment (PPE) – types, proper use, and disposal
- Respiratory hygiene and cough etiquette
- Safe injection practices and needle-stick injury prevention
- Cleaning, disinfecting, and sterilizing medical equipment

Transmission-Based Precautions

- Contact Precautions: Types of infections and examples (e.g., MRSA, C. difficile)
- Droplet Precautions: Infections transmitted by respiratory droplets (e.g., influenza, COVID-19)
- Airborne Precautions: Diseases that require negative pressure rooms (e.g., tuberculosis, measles)
- Special considerations for managing different infection types

Safe Handling of Waste

- Procedures for handling and disposing of contaminated waste and sharps
- Infectious waste segregation and labeling protocols

UNIT-III **7 Hours**

Infection Control in Patient Care Areas

- Isolation rooms: Purpose and proper usage
- Operating rooms and intensive care units (ICUs): Infection control in high-risk areas
- Infectious disease outbreaks in hospitals (managing outbreaks, tracing sources)
- Infection control in maternal and child health settings
- Infection control in dialysis centers

Infection Control in Healthcare Personnel

- Health and safety protocols for healthcare workers
- Employee vaccinations and screenings (e.g., flu, TB, hepatitis B)

- Preventing occupational exposures (e.g., sharps injuries, blood-borne pathogens)
- Post-exposure management and protocols

Infection Control in Visitors and Family Members

- Visitor screening and restrictions during outbreaks
- Ensuring visitor compliance with infection control measures
- Education and training for family members

UNIT-IV **7 Hours**

Surveillance Systems and Reporting

- Infection surveillance: Purpose, methods, and types (e.g., active vs. passive surveillance)
- Tracking infections and outbreaks: Key performance indicators and metrics
- Using data to drive infection control efforts (e.g., infection rate reduction)

Audits and Inspections

- Conducting infection control audits
- Monitoring adherence to infection control protocols
- Corrective actions and improvement plans following audit results

Training and Education

- Role of ongoing education for healthcare staff
- Infection control training programs and their effectiveness
- Building a culture of safety: Encouraging staff engagement and compliance

Research and Advancements in Infection Control

- New technologies in infection prevention (e.g., UV light, antimicrobial surfaces)
- Current research trends and innovations in hospital infection control
- The role of antimicrobial stewardship in preventing infections

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *World Health Organization. WHO Guidelines on Hand Hygiene in Health Care.Geneva: WHO; 2009.*
- *Grol R, Wensing M, Eccles M. Improving Patient Care: The Implementation of Change in Clinical Practice. 2nd ed. Edinburgh: Elsevier; 2013.*
- *Mayo Clinic. Infection Control: Preventing Healthcare-associated Infections. Mayo Clinic Press; 2016.*
- *Goh KT, Salim A, Buehler JW. Microbiology of Hospital Infections. 3rd ed. New York: Springer; 2017.*
- *Spence RP, Stevens DL. Infection Control: A Practical Approach. 1st ed. Oxford: Oxford University Press; 2012.*
- *Centers for Disease Control and Prevention (CDC). Infection Control Guidelines. Atlanta: CDC; 2019.*

Course Title: Radiographic and image processing technique	L	T	P	Cr.
Course Code: BRI3206	4	0	0	4

Total Hours 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the basic principles of X-ray production and interactions with matter.
2. Describe the components and functions of an X-ray imaging system.
3. Understand radiation protection principles and safety measures in radiographic practice.
4. Identify and optimize exposure factors (kVp, mA, exposure time, SID) for quality radiographs.
5. Evaluate the effects of patient positioning and anatomical variations on image quality

Course Contents

UNIT-I **15 Hours**

- Images produced by radiation, Light sensitive photographic materials, Real and virtual images, reflected transmitted and emitted light images, Light sensitivity salts of silver, Photographic emulsions, A brief outline of the formation of the latent image & positive process (conventional & digital).
- Radiographic Film: Type of film, screen and non-screen film, single and double emulsion films, Dental films Structure of film emulsion-film characteristics (speed, base + fog, gamma, latitude), Spectral sensitivity of film material, Effect of grain size on film response to exposure, interpretation of characteristics curve-Grain technology-Gelatin-Basic film types-Film formats and packing-Direct exposure duplitised films-Single coated emulsions-Films for specialized use-manufacturing process. Structure, properties of different parts, handling, film wrappings. Handling of exposed and unexposed films. Types, applications, advantages/limitations of different types, safe light requirements.
- Sensitometer: Photographic density, characteristic curve, features of characteristic curve, Information from the characteristic curve-speed Vs definition. Variation in the characteristic curve with the development.
- Storage of X-ray film: Storage of unprocessed films, Storing of

radiographs, Expiry date, Shelf life, Storage condition, Stock control

UNIT-II **15 Hours**

- Control of scattered radiation: Methods of minimizing formation of scatter radiation, effectiveness of grids-grid ratio-preventing scattered radiation, use of cones, diaphragm light beam devices and effectiveness of collimation in reducing effects of scatter. Effects of scatter radiation on radiograph image quality, patient dose and occupational exposure.
- Intensifying screens: Luminescence, Fluorescence and Phosphorescence, Structure and functions, common phosphors used-types, screen mounting, care and maintenance of film screen contact. Intensifying factor, speed and detail-crossover effect, Resolution, Quantum mottle, reciprocity failure, screen asymmetry, cleaning. New phosphor technology-influence of kilo voltage. Photo-stimulable phosphor Imaging.
- Cassettes (conventional and CR based): Structure and function-Types-single, gridded, film holder Design features and consideration with loading/unloading-Care and maintenance (cleaning).

UNIT-III **15 Hours**

- Radiographic image, components of image quality, unsharpness in radiographic image, contrast of the radiographic image, distinctness of the radiographic image-size, shape and spatial relationships. Factors affecting Image Quality (image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur).
- The presentation of the radiograph, Identification markers and orientation, Documentary preparation, viewing accessories, viewing boxes, Magnifiers, Viewing conditions.

UNIT-IV **15 Hours**

- Manual processing, care of processing equipment, automatic processor-manual VS automatic processing,
- Automatic Film Processor: Functions of various components, Film roller transport-transport time, film feed system, Importance and relation to temp, fixed and variable time cycles, Care and maintenance (cleaning routine and methods of cleaning).
- Dark room layout and planning, Dark room construction, Nature of floor, walls and ceiling and radiation protection, Type of entry, Door design, Dark room illuminations, White light and safe lighting, Dark

room equipment, Location of pass-through boxes or cassette hatches.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- Bushong, S. C. – *Radiologic Science for Technologists: Physics, Biology, and Protection* (Latest Edition)
- Ball, J., Price, T., &Bearcroft, P. – *Merrill's Atlas of Radiographic Positioning & Procedures*
- Carter, C. E., & Veale, B. L. – *Digital Radiography and PACS*
- Whitley, A. S., Sloane, C., et al. – *Clark's Positioning in Radiography*
- Langlotz, C. P. – *AI in Radiology: The New Frontier*

Course Title: Health Education and Health Communication	L	T	P	Cr.
Course Code: BRI3207	4	0	0	4

Total Hours: 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Demonstrate the importance of health education and health communication in promoting individual and community health.
2. Identify key theories and models related to health behavior change.
3. Explore different communication strategies and techniques used in health education.
4. Develop skills in designing and implementing health education programs.

Course Contents

UNIT-I **15 Hours**

Introduction to Health Education and Health Communication, Importance and goals of health education, Role of health communication in behaviour change, Historical perspectives on health education and communication

UNIT-II **15 Hours**

Theories and Models of Health BehaviourChange Social cognitive theory, Transtheoretical model, Health belief model, Ecological model, Effective Communication Strategies, Principles of effective communication

UNIT-III **15 Hours**

Designing Health Education Programs, Assessing needs and setting objectives, Developing educational materials, Planning and implementing health education programs, Evaluating program effectiveness, Verbal and non-verbal communication, Health literacy and plain language, Cultural competence in communication

UNIT-IV **15 Hours**

Media and Technology in Health Communication, Role of media in health communication, Social media and online platforms, Health campaigns andmass media interventions, Ethical considerations in media use, Ethical and Cultural Considerations in Health Education, Ethical guidelines andprinciples, Informed consent and confidentiality, Health communication with vulnerable populations, Evaluation of Health Education and Communication Interventions.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Bandura, A. (2004).Health promotion by social cognitive means. Health Education & Behavior, 31(2), 143-164.*
- *Brashers, D. E., Haas, S. M., &Neidig, J. L. (2014). Health communication and the social networks of older adults: Implications for health and aging. In R. N. Bostrom & B. H. Westley (Eds.), Communication and aging (pp. 193-222). Routledge.*
- *Freimuth, V. S., Quinn, S. C., Thomas, S. B., Cole, G., Zook, E., & Duncan, T. (2001). African Americans' views on research and the Tuskegee Syphilis Study. Social Science & Medicine, 52(5), 797-808.*
- *Kreps, G. L., & Sparks, L. (2008). Meeting the health literacy needs of immigrant populations. Patient Education and Counseling, 71(3), 328-332*

4th SEMESTER

Course Title: Clinical Radiography Positioning-II	L	T	P	Cr.
Course Code: BRI4250	3	0	0	3

Total Hours 45hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Modify Positioning for Special Cases – Adapt positioning techniques for trauma, pediatric, geriatric, and non-ambulatory patients.
2. Use Immobilization Techniques – Utilize appropriate methods to minimize patient movement and enhance image clarity.
3. Demonstrate Competence in Specialized Imaging – Understand positioning considerations for fluoroscopy, CT, and contrast-enhanced studies.
4. Communicate Effectively with Patients – Provide clear instructions to patients to ensure cooperation and comfort during imaging procedures.
5. Maintain Professionalism and Ethical Conduct – Adhere to ethical and legal standards in patient care and radiographic practice.

Course Contents

UNIT-I **15 Hours**

Abdomen- Technique for plain film examination, Projection for acute abdomen patients, Technique to demonstrate: Foreign bodies, Imperforate anus. Pelvic girdle and hip region: Technique for whole pelvis. Ilium, ischium, pubic bones, sacroiliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter. Supplementary techniques for congenital dislocation of hips, epiphysis of femur, lateral projections for hip joints to show femoral head and neck relationship.

UNIT-II **10 Hours**

Skull: Basic projections for cranium, facial bones, nasal bones and mandible. Technique for temporal bone, mastoids. Internal auditory canal. Paranasal sinuses, Temporo - mandibular joint. - Orbits and optic foramen.- Zygomatic arches. Styloid process. - Pituitary fossa. - Jugular foramen.

UNIT-III **10 Hours**

Vertebral column: Technique for atlanto-occipital joint, cervical spine, cervico thoracic spine, thoracic spine, thoraco- lumber spine, lumbo sacral

spine, sacrum and coccyx. Supplementary techniques to demonstrate intervertebral foramina

UNIT-IV **10 Hours**

Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography. 8. High KV techniques principle in radiography and its applications. Trauma radiography/Emergency radiography Neonatal and Pediatric Radiography, Dental Radiography Technique for intra oral full mouth.- Occlusal projections.- Extra oral projections including orthopantomography.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Dahnert W. Radiology review manual. 8th ed. Philadelphia, PA: Wolters Kluwer; 2017.*
- *Ball J, Price T. Essentials of radiographic physics and imaging. 2nd ed. St. Louis, MO: Elsevier; 2019.*
- *Fauber TL. Radiographic imaging and exposure. 6th ed. St. Louis, MO: Elsevier; 2020.*
- *Carroll QB. Radiography in the digital age. 3rd ed. Springfield, IL: Charles C Thomas; 2018.*
- *European Society of Radiology (ESR). Clinical guidelines for radiographic positioning and techniques [Internet]. Vienna: ESR; 2021 [cited 2025 Mar 22]. Available from: https://www.myesr.org/*

Course Title: Special Radiography Procedures I	L	T	P	Cr.
Course Code: BRI4251	3	0	0	3

Total Hours 45hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the principles and indications of special radiographic procedures, including fluoroscopy, contrast studies, and interventional techniques.
2. Demonstrate knowledge of contrast media, including types, administration, contraindications, and patient safety considerations.
3. Describe and explain procedural steps for specialized imaging studies such as angiography, myelography, hysterosalpingography, arthrography, and gastrointestinal studies.
4. Recognize normal and pathological findings in specialized radiographic procedures and understand their clinical significance.
5. Apply radiation protection principles to both patients and healthcare providers in special procedures.

Course Contents

UNIT-I **10 Hours**

Introduction to Contrast Media

- Types: Positive (iodinated, barium) vs. Negative (air, CO_2) contrast
- Pharmacokinetics and pharmacodynamics of contrast agents
- Mechanisms of contrast enhancement in different imaging modalities

Classification and Properties of Contrast Media

- Water-soluble vs. non-water-soluble contrast
- Osmolality and viscosity considerations
- Selection of contrast based on clinical indications

Adverse Reactions & Contrast Safety

- Contrast-induced nephropathy (CIN) and preventive measures
- Anaphylactic and allergic reactions: Risk factors and management
- Gadolinium-based contrast agents: Nephrogenic systemic fibrosis (NSF)

UNIT-II **15 Hours**

Barium studies

- Barium Swallow (Esophagogram)
- Barium Meal (Upper GI Study)
- Small Bowel Follow-Through (SBFT)
- Enteroclysis (Small Bowel Enema)
- Barium Enema (BE) – Colon Study
- Defecography (Dynamic Barium Study of Anorectal Function)

UNIT-III **10 Hours**

Biliary system:

- Intravenous cholangiography
- Percutaneous cholangiography
- Endoscopic retrograde cholangio-pancreatography (ERCP)
- Operative cholangiography
- Post-Operative cholangiography (T - tube Cholangiography)

UNIT-IV **10 Hours**

Urinary system:

- Intravenous urography
- Retrograde pyelography
- Antegrade pyelography
- Cystography and micturating cystouresthrography
- Urethrography (ascending)
- Renal puncture

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Bontrager KW, Lampignano JP. Textbook of radiographic positioning and related anatomy. 10th ed. St. Louis: Elsevier; 2020.*

- *Bushong SC. Radiologic science for technologists: physics, biology, and protection. 11th ed. St. Louis: Elsevier; 2021.*
- *Mettler FA. Essentials of radiology. 4th ed. Philadelphia: Elsevier; 2019.*
- *Statkiewicz Sherer MA, Visconti PJ, Ritenour ER, Haynes K. Radiation protection in medical radiography. 9th ed. St. Louis: Mosby; 2021.*
- *Callaway WJ. Mosby's comprehensive review of radiography: the complete study guide and career planner. 8th ed. St. Louis: Elsevier; 2022.*

Course Title: Modern Radiological & Imaging Equipment	L	T	P	Cr.
Course Code: BRI4252	3	0	0	3

Total Hours 45hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the principles and technological advancements of modern radiological equipment, including MRI, CT, ultrasound, and digital X-ray.
2. Describe the working mechanisms of key imaging modalities, including image acquisition, processing, and display.
3. Evaluate the advantages and limitations of different imaging techniques in various clinical applications.
4. Apply radiation safety principles and ALARA (As Low As Reasonably Achievable) guidelines in clinical imaging.
5. Interpret quality assurance protocols and maintenance requirements for modern radiological systems.

Course Contents

UNIT-I **15 Hours**

Special radiological equipment: Portable and mobile x-ray units, dental xray machine, skull table mammographic device - Technical aspects of Mammography; High Tension Generators, x-ray tubes-their types and advancements; Accessories; Resolution; Quality control; Application and role in medicine, digital radiography equipment, digital subtraction techniques. Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of tomographic movements, Tomosynthesis, Stich radiography, Dual energy x-ray absorptionometry (DEXA) scan.

UNIT-II **15 Hours**

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

UNIT-III **10 Hours**

Vascular Imaging Equipment: Introduction, historical developments, Principle, scanned projection radiography, digital subtraction angiography, applications and definition of terms,

UNIT-IV **05 Hours**

Picture archiving and communication system (PACS), RIS, HIS, DICOM

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Bushberg JT, Seibert JA, Leidholdt EM, Boone JM. The essential physics of medical imaging. 4th ed. Philadelphia: Wolters Kluwer; 2021.*
- *Hsieh J. Computed tomography: principles, design, artifacts, and recent advances. 3rd ed. Boca Raton: CRC Press; 2015.*
- *McRobbie DW, Moore EA, Graves MJ, Prince MR. MRI: from picture to proton. 3rd ed. Cambridge: Cambridge University Press; 2017.*
- *Webb A. Introduction to biomedical imaging. 2nd ed. Hoboken: Wiley-IEEE Press; 2018.*
- *Suetens P. Fundamentals of medical imaging. 3rd ed. Cambridge: Cambridge University Press; 2017.*

Course Title: Hospital Practice and Patient Care	L	T	P	Cr.
Course Code: BRI4253	4	0	0	4

Total Hours 60hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand hospital workflows – Describe the structure and function of hospital departments, including radiology, emergency, and intensive care units.
2. Demonstrate patient-centered care – Apply ethical principles, communication strategies, and teamwork to improve patient outcomes.
3. Interpret hospital-based diagnostic and therapeutic procedures – Understand the role of imaging modalities and laboratory tests in patient management.
4. Apply infection control and safety protocols – Identify hospital-acquired infections (HAIs) and implement best practices in patient safety.
5. Integrate interdisciplinary collaboration – Work effectively with healthcare professionals, including physicians, nurses, and technologists, for optimal patient care.

Course Contents

UNIT-I **15 Hours**

Departmental Organization & record maintenance Department staffing; performance appraisal, conflict management Procedure appointments, organization; minimizing waiting time. Records relating to patients and departmental statistics

UNIT-II **15 Hours**

Basics of emergency care and life support skills - Basic life support (BLS) is the foundation for saving lives following cardiac arrest. The student is also expected to learn about basic emergency care including first aid and triage. Topics to be covered under the subject are as follows: a. Vital signs and primary assessment - Body temp, respiratory rate, pulse, blood pressure b. Basic emergency care – first aid and triage c. Ventilations including use of bag-valve-masks (BVMs) d. Choking, rescue breathing methods e. CPR f.

Using an AED (Automated external defibrillator). g. Managing an emergency including moving a patient h. Oxygen therapy, oxygen devices.

UNIT-III **15 Hours**

First aid for common conditions: Aims and objectives of first aid Wounds and bleeding, dressing and bandages; fractures and splints, supports etc. Shock; unconsciousness, asphyxia; convulsions; drug reactions, Foreign bodies; poisons. Electric shock; burns; scalds; hemorrhage (pressure points; compression band). Chest tubes and lines

UNIT-IV **15 Hours**

Infection and principles of asepsis Introduction of microbiology, Classification of microorganisms (viruses, bacteria, fungi, protozoa, parasitic infection), Mode of spread of infections, auto-infection or cross-infection Universal precautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc. Principles of asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care and identification of instruments (autoclave, serum inspissator, pasteurization). Handling of infectious patients in the department and in the ward.

Drugs in the department: Storage: classification; labelling and checking. Administration of drugs and contrast media. Regulation of dangerous drugs. Emergency drugs

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Berwick DM. Improvement, trust, and the future of healthcare. JAMA. 2021;325(11):1045-6.*
- *Gawande A. Being mortal: Medicine and what matters in the end. New York: Metropolitan Books; 2014.*
- *Makary MA. The price we pay: What broke American health care—and how to fix it. New York: Bloomsbury Publishing; 2019.*
- *Hall JE, Guyton AC. Guyton and Hall textbook of medical physiology. 14th ed. Philadelphia: Elsevier; 2020.*
- *Fauci AS, Kasper DL, Hauser SL, et al. Harrison's principles of internal*

medicine. 21st ed. New York: McGraw-Hill Education; 2022.

Course Title: Clinical Radiography Positioning-II Lab	L	T	P	Cr.
Course Code: BRI4254	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Demonstrate proper patient positioning for advanced radiographic procedures, including skull, spine, and contrast studies.
2. Apply appropriate radiographic techniques to optimize image quality while minimizing radiation exposure.
3. Evaluate radiographic images for diagnostic quality, positioning accuracy, and technical factors.
4. Practice radiation protection principles in compliance with ALARA (As Low As Reasonably Achievable) guidelines.
5. Recognize anatomical landmarks and their significance in radiographic positioning.

Course Contents

List of Practical's / Experiments **30 HOURS**

1. Abdomen & Pelvic Girdle Radiography
2. Whole Pelvis and Hip Region Radiography
3. Skull Radiography
4. Vertebral Column Radiography

Course Title: Special Radiography Procedures I Lab	L	T	P	Cr.
Course Code: BRI4255	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Demonstrate proficiency in patient preparation for special radiographic procedures, including contrast studies and interventional techniques.
2. Identify and apply radiation safety measures specific to fluoroscopic and angiographic imaging.
3. Perform contrast media administration procedures with proper aseptic techniques and patient monitoring.
4. Explain and execute specialized imaging protocols for procedures such as myelography, arthrography, hysterosalpingography, and angiography.
5. Analyze radiographic images to assess technical quality and identify anatomical structures relevant to special procedures.

Course Contents

List of Practical's / Experiments **30 HOURS**

1. Introduction to Contrast Media
2. Barium studies
3. Biliary system
4. Urinary system

Course Title: Modern Radiological & imaging Equipment Lab	L	T	P	Cr.
Course Code: BRI4256	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the working principles of radiographic, fluoroscopic, CT, MRI, ultrasound, and nuclear imaging equipment.
2. Compare image acquisition methods, reconstruction techniques, and post-processing workflows.
3. Assess image quality parameters (contrast, resolution, noise, artifacts).
4. Identify common image artifacts and propose corrective measures.
5. Recognize equipment malfunctions and understand basic troubleshooting.

Course Contents

List of Practical's / Experiments **30 HOURS**

1. Structure and components of modern X-ray systems.
2. Digital radiography (DR) and computed radiography (CR) principles.
3. Fluoroscopy: Continuous imaging, contrast studies, and dose optimization.
4. Overview of radiological and imaging modalities.
5. Principles of image formation and digital imaging basics.
6. PET-CT and PET-MRI: Physics, instrumentation, and applications.

Course Title: English for Research Writing	L	T	P	Cr.
Course Code: BRI4257	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the structure and conventions of academic research writing and use appropriate academic vocabulary.
2. Critically analyze and synthesize information from research articles.
3. Write different sections of a research paper, including abstracts, introductions, methods, results, and discussions.
4. Format and cite sources accurately using recognized citation styles (e.g., APA, Vancouver).
5. Students will be able to apply academic writing conventions, including appropriate use of citations, referencing, and academic tone, to produce high-quality research papers.

Course Content

Unit I **7 Hours**

Foundations of Academic Writing and Reading

- Introduction to academic writing: purpose, audience, and style.
- Understanding the structure of a research article.
- Developing critical reading skills: skimming, scanning, and in-depth analysis.
- Identifying and evaluating sources of information.
- Introduction to academic integrity and plagiarism.

Unit II **7 Hours**

Grammar and Vocabulary for Scientific Communication

- Review of essential grammar: verb tenses, subject-verb agreement, and sentence structure.
- Use of passive voice and nominalization in scientific writing.
- Building academic vocabulary: roots, prefixes, and suffixes.
- Medical terminology: definitions and usage.
- Hedging and boosting: expressing certainty and uncertainty.

Unit III **7 Hours**

Writing the Research Paper

- Writing abstracts: summarizing key findings.
- Writing introductions: establishing the research context and purpose.
- Writing methods: describing the research design and procedures.
- Writing results: presenting data and findings
- Writing discussions: interpreting and analyzing results.
- Writing case reports.

Unit IV **9 Hours**

Referencing and Presentation

- Introduction to citation styles: APA and Vancouver.
- Creating and formatting references and bibliographies.
- Designing effective tables and figures.
- Revision and editing techniques.
- Introduction to the publication process.
- Basics of research presentation.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Swales, J. M., & Feak, C. B. (2012). Academic writing for graduate students: Essential tasks and skills. University of Michigan Press.*
- *Day, R. A., & Gastel, B. (2011). How to write and publish a scientific paper. Cambridge University Press.*
- *Pechenik, J. A. (2016). A short guide to writing about biology. Pearson.*
- *American Psychological Association. (2020). Publication manual of the American Psychological Association (7th ed.).*
- *International Committee of Medical Journal Editors. (ICMJE). (Various years). Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals. Available at: www.icmje.org*
- *O'Connor, M. (1991). Writing successfully in science. HarperCollins Academic.*

- *Jordan, R.R. (1997). English for Academic Purposes: A guide and resource book for teachers. Cambridge University Press.*

Course Title: Indian Education	L	T	P	Cr.
Course Code: IKS0002	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: On the completion of the course, the students will able:

1. Understand the Indian Education Pre-Vedic and Post Vedic Period
2. Critically analyse the Paravidhya and Apravidhya in Indian education
3. Examine the methods of Vedas, Jainisism and Bhodhsim Education
4. Development the curriculum according to Vedas, Jainisism and Bhodhsim

Course Content

Unit-I **7 Hours**

Religion and Philosophy in India: Ancient Period: Pre-Vedic and Vedic Religion, Buddhism and Jainism, Indian philosophy – Vedanta and Mimansa school of Philosophy

Unit-II **7 Hours**

Paravidya: Relation between God and Self and Aparavidya: Vedas, Vedangas, Rituals, Astronomy, Ithihasas, Puranas, Ethics and Military sciences etc.

Unit-III **8 Hours**

Methods of teaching: Vedic Education: - Saravana, Manana, Nididhyasana and Intuition/revelation Jainisism – Matigyan, saruti Gyan, Avvidhiyagyan, Man: Paryav, Kaveleye

Bhodhsim- Direct and application Method, Lecture Method, Practice Method, Knowledge through conversation, Questioner answer Method

Unit-IV **8 Hours**

Vedas- Mantel Development, Physical Development and Seprulity development, Jainisim- Dravye, Astikay and Anistakay

Bhodhisim- four Arya Truth (Shabad Vidhya, Chikitasya Vidhya and Shilpasan Vidhya, Hetu Vidhya and Adhyatam Vidhya

Transactional Mode: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested Readings:

- *Chaudhuri, Kirti N.: Trade and Civilisation in the Indian Ocean, CUP, Cambridge, 1985.*
- *Malekandathil, Pius: Maritime India: Trade, Religion and Polity in the Indian Ocean, Primus*
- *McPherson, Kenneth: The early Maritime Trade of the Indian Ocean, in: ib.: The Indian*
- *Ocean: A History of People and The Sea, OUP, 1993, pp. 16-75.*
- *Christie, J.W., 1995, State formation In early Maritime Southeast Asia, BTLV*
- *Christie, J.W., 1999, The Banigrama in the Indian Ocean and the Java sea during the early*

Course Title: Newer Imaging Modalities	L	T	P	Cr
Course Code: BRI4259	4	0	0	4

Total Hours 60hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the principles and technological advancements in modern imaging modalities such as MRI, CT, and advanced ultrasound techniques.
2. Evaluate the clinical applications and advantages of newer imaging modalities compared to conventional methods.
3. Analyze recent research and emerging trends in imaging, including artificial intelligence integration and quantitative imaging.
4. Discuss safety considerations, radiation dose optimization, and contrast agent innovations in advanced imaging techniques.
5. Apply knowledge of new imaging technologies to clinical decision-making and patient management.

Course Contents

UNIT-I **15 Hours**

CT: Basic Computed Tomography- Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT image display, Artifacts

UNIT-II **15 Hours**

MRI: Principle, nuclear magnetism, Quantum mechanical Description , A spinning proton induces nuclear magnetism, Larmer equation, Net magnetization. MR Instrumentation: Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers. Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP. Artifacts

UNIT-III **15 Hours**

ULTRASOUND: Ultrasonography and Doppler a. Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity. b. Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing. c. Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam. d. Ultrasound display modes: A, B, M e. Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements. Artifacts

Unit-IV **15 Hours**

PET MRI AND CT: PET imaging – principles and application, Fusion Imaging including PET-CT, PET- MRI.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Beckmann N, Laurent D, Tigani B. Advanced molecular imaging in biomedical research. Future Med Chem. 2022;14(5):349-365.*
- *McCollough CH, Boedeker K, Cody D, et al. Principles and applications of photon-counting CT. Radiology. 2023;306(2):217-232.*
- *Ehman EC, Johnson GB, Villanueva-Meyer JE, et al. PET/MRI: Applications and challenges in oncology. AJR Am J Roentgenol. 2021;216(1):30-45.*
- *Rubin GD, Kanne JP, Harmon SA. AI in radiology: Advances, challenges, and clinical impact. Radiographics. 2024;44(1):12-29.*
- *Gossner J. Spectral CT: Technological advancements and clinical applications. Eur J Radiol. 2023;161:110607.*

Course Title: Radiation Protection & Management of Radiology Department	L	T	P	Cr.
Course Code: BRI4260	4	0	0	4

Total Hours: 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Optimize and manage radiation doses for diagnostic and therapeutic procedures, considering patient-specific factors and clinical indications.
2. Manage radiation monitoring programs, including personnel dosimetry, patient dose tracking, and monitoring of radiation levels in radiology departments.
3. Oversee the maintenance, repair, and replacement of radiology equipment, ensuring compliance with safety and regulatory standards.
4. Promote and foster a culture of radiation safety among staff, emphasizing their responsibilities in maintaining a safe work environment.

Course Contents

UNIT-I **15 Hours**

Introduction to Radiation Protection, Units &Quantities,Primary, secondary radiation, need for radiation protection , Exposure, Absorbed dose, equivalent, Effective dose, air KERMA.

UNIT-II **15 Hours**

Aim & Principle of Radiation Protection: Concept of ALARA, Cardinal Principle, ICRP regulation, Radiation Protection in: Radiography, CT, Fluoroscopy, Mammography, Ward radiography, radiation shielding, Personnel – Film badge, TLD, OSLD, pocket dosimeter, Area monitoring Devices.

UNIT-III **15 Hours**

Radiobiology: Radiolysis of water, Direct & Indirect effects of radiation, Stochastic, Deterministic effects, Somatic, Genetic effects.

UNIT-IV **15 Hours**

Radiation Regulation & Planning of Radiology Department,x-ray room lay out, dark room lay out, CT lay out and Fluoroscopy lay out.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Christensen, Physics of Diagnostic radiology Euclid Serum, Radiation Protection ThalayinK.,Text book of Radiological Safety.*
- *James E. M., The Physics for Radiation Protection, ICRP manual.*

5th SEMESTER

Course Title: MRI Physics	L	T	P	Cr.
Course Code: BRI5300	3	0	0	3

Total Hours 45hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the fundamental principles of nuclear magnetic resonance (NMR) and its application in MRI
2. Describe the role of T1 and T2 relaxation times in image contrast formation
3. Analyze the effects of pulse sequences on image quality and diagnostic accuracy
4. Evaluate the impact of gradient fields and k-space encoding on spatial resolution and signal acquisition
5. Identify artifacts in MRI images and propose strategies to minimize them

Course Contents

UNIT-I **10 Hours**

Introduction and Basic Principle of Magnetic Resonance Imaging History of MRI, Electricity & Magnetism, Laws of magnetism, Atomic structure, Motion within the atom, The Hydrogen nucleus, Precession, Larmor equation, Resonance, MR signal, Free induction decay signal, Relaxation, T1recovery, T2decay, Pulse timing &parameters.

UNIT-II **10 Hours**

MRI Hardware Introduction, Permanent magnets, Electromagnets, Super conducting magnets, Fringe fields, Shim coils, Gradient coils, Radio-frequency coils, the pulse control units, Patient transportation system, Operator interface Encoding, Data collection& Image formation Introduction, Gradients, Slice selection, Frequency encoding, Phase encoding, Scantiming, Sampling, dataspace, ks pace, k-space filling and fast Fourier transformation.

UNIT-III **15 Hours**

Pulse sequences Introduction To basic pulse sequences. Spin echo sequences, Conventional spin echo, Fast spin echo Inversion recovery, STIR,FLAIR Proton Density Imaging, Gradient echo pulse sequences Conventional gradient echo, The study state, SSFP, Coherent residual transverse magnetization,Incoherentresidualtransversemagnetization,Ultra-fastimaging,Advanced imaging techniques, EPI MRI parameters &Trade offs Introduction, Signal To Noise Ratio (SNR) & How to increase SNR, Contrast to Noise Ratio(CNR), Spatial resolution & how to increase the spatial resolution, Scan time & how to reduce time,Trade offs,Decision making, Volume imaging.

UNIT-IV **10 Hours**

MRI Artefacts Introduction, Phase miss-mapping, Aliasing or wrap around, Chemical shift artefact, Chemical miss registration, Truncation artefact/Gibbs phenomenon, Motion of the patient Magnetic susceptibility artefact, Magic angle artefact, Zipper artefact, shading artefact Cross excitation and crosstalk MRI contrast agents

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Haacke EM, Brown RW, Thompson MR, Venkatesan R. Magnetic Resonance Imaging: Physical Principles and Sequence Design. 2nd ed. Wiley-Blackwell; 2014.*
- *Bernstein MA, King KF, Zhou XJ. Handbook of MRI Pulse Sequences. Elsevier Academic Press; 2004.*
- *McRobbie DW, Moore EA, Graves MJ, Prince MR. MRI: From Picture to Proton. 3rd ed. Cambridge University Press; 2017.*
- *Bushberg JT, Seibert JA, Leidholdt EM Jr, Boone JM. The Essential Physics of Medical Imaging. 3rd ed. Lippincott Williams & Wilkins; 2011.*
- *Wood ML, Henkelman RM. MR image artifacts from periodic motion. Med Phys. 1985;12(2):143-151.*

Course Title: CT Physics	L	T	P	Cr.
Course Code: BRI5301	3	0	0	3

Total Hours 45hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Describe the basic principles of X-ray generation and photon interactions in CT.
2. Explain the role of attenuation coefficients in CT image formation.
3. Outline the function of CT scanner components (X-ray tube, detectors, collimators, etc.).
4. Define key image quality parameters: spatial resolution, contrast resolution, noise, and artifacts.
5. Explain the impact of kVp, mAs, and dose modulation on image quality.

Course Contents

UNIT-I **10 Hours**

Introduction to Computed Tomography and Principle of Computed Tomography History, Advantage and Disadvantages of CT, Basic principle of CT Generations of Computed Tomography-1st generation,2nd generation,3rd generation, Slipring technology,4th generation, Electron beam CT, Dual Source CT, Flat Panel Detector CT Single and Multislice Technology

UNIT-II **10 Hours**

Instrumentation-CT scannergantry, Detectors & Data Acquisition System, Generator, Computer and image processing System Image display system, storage, recording and communication system, CT control console, Options and accessories for CT systems.

UNIT-III **10 Hours**

Image Reconstruction-Basic principle, Reconstruction algorithms, Imagere construction from projections, Types of data reconstruction Image Display and Image Quality Image formation and representation, Image processing, Pixel and voxel, CT number Window level and window width, Qualities, Resolution, Contrast, Sharpness, Noise properties in CT

UNIT-IV **15 Hours**

CT Artifacts- Classification, Types, Causes, Remedies Diagnostic aspects of CT and post Processing Techniques HRCT, Isotropic imaging, Patient management, Patient preparation, positioning, Technologist role, Protocols for whole body imaging Clinical applications of CT, 2D&3Dimaging, MPR, SSD, Volume Rendering, BMD.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Bushberg JT, Seibert JA, Leidholdt EM Jr, Boone JM. The Essential Physics of Medical Imaging. 3rd ed. Lippincott Williams & Wilkins; 2012.*
- *Hsieh J. Computed Tomography: Principles, Design, Artifacts, and Recent Advances. 3rd ed. SPIE Press; 2015.*
- *Goldman LW. Principles of CT: Radiation Dose and Image Quality. J Nucl Med Technol. 2007;35(4):213-225.*
- *Kalender WA. Computed Tomography: Fundamentals, System Technology, Image Quality, Applications. 3rd ed. Wiley-VCH; 2011.*
- *McCollough CH, Chen GH, Kalender W, et al. Achieving routine sub-millisievert CT scanning: report from the summit on management of radiation dose in CT. Radiology. 2012;264(2):567-580.*

Course Title: Basics of hospital skill learning	L	T	P	Cr.
Course Code: BRI5302	4	0	0	4

Total Hours 60hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the basic ideas on how to check for Vital Signs of the Patient
2. Learn how to handle the patients and their positioning
3. Learn on the Basics of Nasal-Gastric Tube
4. Learn on Administration of IV, IV and Medication
5. Know about Cleanliness in the Asepsis

Course Contents

UNIT-I **15 Hours**

MEASURING VITAL SIGNS: Temperature: Axillaries Temperature, Pulse: Sites of pulse, Measurement, Respiratory, Blood Pressure, Pain: Pain Scale PHYSICAL EXAMINATION: Observation, Auscultation (Chest), Palpation, Percussion, History Taking

UNIT-II **15 Hours**

FEEDING: ENTRAL FEEDING, NG TUBE: Measurement, Procedure, Care, Removal of Nasal-Gastric Tube, Nasal-Gastric Tube Feeding, and Parentral Nutrition. MOBILITY AND SUPPORT: Moving and Positioning, range of Motion exercises (Active & Passive) Assisting for Transfer, Application of Restraints

UNIT-III **15 Hours**

ADMINISTRATIONS: Oral, Intravenous, Intramuscular, Subcutaneous, Recapping of Syringe, Loading of Drugs, Calculation of Drugs, Venipuncture, IV Infusion, Cannula, Attachment of IV infusion Set, Fluid Collection, Heparin Lock, Maintenance of IV set, Performing Nebulizer Therapy, Inhaler, Oxygen Therapy (Nasal, prongs, nasal Catheter, Venturi Mask, face mask)

UNIT-IV **15 Hours**

ASEPSIS: Hand wash Techniques, (Medical, Surgical) Universal Precaution, Protecting Equipments: Using Sterile Gloves, opening a Sterile package and Establishing a Sterile Field, Sterile Dressing Changes, Surgical Attire, Wound Dressing, Suture Removal, Cleaning and Application of Sterile Dressing, Wearing and Removal of personal protective Equipment

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Scott IA. Health care system performance and physician training: A review of current problems and future directions. Med J Aust. 2019;211(1):39-42.*
- *Wachter RM. Understanding patient safety. 3rd ed. McGraw-Hill Education; 2017.*
- *Leonard M, Graham S, Bonacum D. The human factor: The critical importance of effective teamwork and communication in providing safe care. Qual Saf Health Care. 2004;13(Suppl 1):i85-i90.*
- *World Health Organization. Patient safety curriculum guide: multi-professional edition. WHO Press; 2011.*
- *Centers for Disease Control and Prevention. Guide to Infection Prevention for Outpatient Settings. CDC; 2016.*

Course Title: Research Methodology and Biostatics	L	T	P	Cr.
Course Code: BRI5303	4	0	0	4

Total Hours 60hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the Basics of Research
2. Formulate a Research Problem
3. Study Design & Data Collection
4. Data Management & Analysis
5. Scientific Writing & Publication

Course Contents

UNIT 1 **15 hours**

Introduction to Research: Definition of Research, Types & Methods of research Applied versus Fundamental research, exploratory research, Observational research, Inductive and Deductive approaches; Designing Research protocol: Research Protocol Development, Literature search, Identification of Research problem, Research gap, Research question, Research Hypothesis, Null and Alternative Hypothesis, Study Objectives; Data and types: Types of Data, Primary and Secondary data, Scales of measurement of data- Nominal data, Ordinal, Interval and Ratio scale, Variables and Confounders, Dependent and Independent Variables, Extraneous variable, Control variable.

UNIT 2 **15 hours**

Literature Review: Importance of literature review, Sources of literature: Journals, books, and online databases, Organizing and synthesizing research findings; Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Different Research Designs, Basic Principles of Experimental Designs; Study population: Selecting Cases and Control, Comparison Group, Target population, Matching, Case Definition, Inclusion and Exclusion Criteria; Qualitative vs. Quantitative research methods; Data Collection and analysis : Types and sources of data – Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods – sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling.

Unit 3 **15 hours**

Statistics: Measures of central tendency: Mean, median, and mode, Measures of dispersion: Range, variance, and standard deviation, Frequency distributions and histograms, Data visualization: Bar charts, pie charts, and box plots; Probability and Probability Distributions: Basic probability concepts, Probability distributions: Normal distribution, binomial distribution, and Poisson distribution, Law of large numbers and central limit theorem.

Unit 4 **15 hours**

Chi-square test for independence and goodness of fit, One-way and two-way analysis of variance (ANOVA), Post-hoc tests following ANOVA; Regression Analysis: Simple linear regression, Multiple linear regression, Model assumptions and diagnostics, Logistic regression (binary outcomes), Poisson regression (count data); Biostatistics for Clinical Trials: Design and analysis of clinical trials, Randomization techniques, Statistical monitoring of trials, Regulatory considerations (e.g., FDA guidelines**.**

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Creswell, J.W. & Creswell, J.D. – Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*
- *Hulley, S.B., Cummings, S.R., Browner, W.S., et al. – Designing Clinical Research*
- *Kothari, C.R. & Garg, G. – Research Methodology: Methods and Techniques*
- *Bland, M. – An Introduction to Medical Statistics*
- *Rosner, B. – Fundamentals of Biostatistics*
- *Dawson, B. & Trapp, R.G. – Basic & Clinical Biostatistics*
- *Daniel, W.W. & Cross, C.L. – Biostatistics: A Foundation for Analysis in the Health Sciences*
- *Zhou, X-H., Obuchowski, N.A., McClish, D.K. – Statistical Methods in Diagnostic Medicine*

Course Title: MRI Physics Lab	L	T	P	Cr.
Course Code: BRI5304	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the fundamental physics behind MRI, including spin, precession, and relaxation.
2. Describe the role of magnetic fields, radiofrequency pulses, and gradients in image formation.
3. Explain the fundamental physics behind MRI, including spin, precession, and relaxation.
4. Describe the role of magnetic fields, radiofrequency pulses, and gradients in image formation.
5. Adjust pulse sequences and imaging parameters to optimize contrast and resolution.

Course Contents

List of Practical's / Experiments: 30 Hours

1. Understanding MRI components: magnet, gradient coils, RF coils, and console.
2. MRI safety protocols: static field, RF, and gradient-related safety.
3. Demonstrating the concept of nuclear magnetic resonance (NMR).
4. Understanding Larmor frequency and resonance conditions.
5. Observing the effects of T1 and T2 relaxation times.
6. Acquiring images using spin-echo (SE) and gradient-echo (GRE) sequences.
7. Evaluating the effect of repetition time (TR) and echo time (TE) on image contrast.
8. Comparing T1-weighted, T2-weighted, and proton density images.
9. Understanding the principles of in vivo MR spectroscopy.
10. Acquisition and analysis of metabolic spectra from brain or muscle.

Course Title: CT Physics Lab	L	T	P	Cr.
Course Code: BRI5305	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the fundamental principles of computed tomography (CT) image formation, including X-ray interactions, attenuation, and reconstruction algorithms.
2. Evaluate the effects of different scan parameters (kVp, mA, pitch, slice thickness) on image quality and radiation dose.
3. Analyze CT image artifacts, their causes, and potential corrective strategies.
4. Demonstrate proficiency in measuring CT dose indices (CTDI, DLP) and applying dose optimization techniques.
5. Compare different CT scanner technologies, including single-slice and multi-slice systems.

Course Contents

List of Practical's / Experiments: 30 Hours

1. Understanding X-ray attenuation and Hounsfield Unit (HU) calculations
2. Exploring the principles of filtered back projection (FBP) and iterative reconstruction
3. Identifying and understanding the components of a CT scanner (X-ray tube, detectors, gantry, etc.)
4. Evaluating differences between single-slice and multi-slice CT (MSCT)
5. Identifying common CT artifacts (beam hardening, motion, metal, streaking, etc.)
6. Implementing correction techniques to reduce artifacts
7. Generating multiplanar reconstructions (MPR) and maximum intensity projections (MIP)
8. Understanding volume rendering techniques (VRT) and their clinical applications
9. Identifying common CT artifacts (beam hardening, motion, metal, streaking, etc.)
10. Implementing correction techniques to reduce artifacts

Course Title: Cross-Sectional Anatomy & Physiology	L	T	P	Cr.
Course Code: BRI5306	4	0	0	4

Total Hours 60hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Identify anatomical structures in cross-sectional images using CT, MRI, and ultrasound modalities.
2. Describe the spatial relationships between major organs and systems in different planes (axial, sagittal, and coronal).
3. Explain the physiological functions of key organs and their relevance in imaging interpretation.
4. Correlate anatomical variations with normal and pathological imaging findings.
5. Interpret cross-sectional images to differentiate normal from abnormal findings.

Course Contents

UNIT-I **15 Hours**

Basics of Cross-Sectional Imaging

- Introduction to imaging modalities (CT, MRI, US)
- Anatomical planes: Axial, Coronal, Sagittal, and Oblique
- Importance of contrast agents in imaging

Head and Neck Anatomy & Physiology

- Brain anatomy in CT and MRI: Major lobes, ventricles, and blood supply
- Cranial nerves and their imaging significance
- Neck structures: Thyroid, salivary glands, lymph nodes, and vasculature

UNIT-II **15 Hours**

Thoracic Cross-Sectional Anatomy

- Lungs and mediastinum: Airways, lobes, and vasculature
- Heart and great vessels: Chambers, coronary arteries, and pericardium
- Pleura, diaphragm, and lymphatic system

Physiology of the Respiratory and Cardiovascular Systems

- Gas exchange and pulmonary circulation
- Hemodynamics and cardiac cycle in imaging
- Role of imaging in detecting pulmonary embolism and cardiac diseases

UNIT-III **15 Hours**

Abdominal Cross-Sectional Anatomy

- Liver, gallbladder, and biliary system in CT & MRI
- Pancreas, spleen, and gastrointestinal tract
- Renal system: Kidneys, ureters, and bladder

Pelvic Cross-Sectional Anatomy

- Male pelvis: Prostate, seminal vesicles, and reproductive organs
- Female pelvis: Uterus, ovaries, and fallopian tubes
- Pelvic floor muscles and vascular structures

Physiology of Digestive & Urinary Systems

- Hepatic metabolism and bile secretion
- Kidney function, filtration, and urine formation
- Imaging in liver cirrhosis, renal failure, and bowel obstruction

UNIT-IV **15 Hours**

Musculoskeletal Cross-Sectional Anatomy

- Spine: Vertebrae, spinal cord, and intervertebral discs
- Joints and soft tissues in CT & MRI
- Upper and lower limb cross-sections

Neurovascular & Lymphatic Systems

- Brain perfusion imaging and neurophysiology
- Vascular imaging: CTA, MRA, and Doppler studies
- Lymphatic drainage and imaging in oncology

Clinical Applications & Emerging Trends

- AI in cross-sectional imaging
- Functional MRI and diffusion imaging
- Advances in 3D reconstruction for surgical planning

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Moore KL, Dalley AF, Agur AMR. Clinically oriented anatomy. 8th ed. Philadelphia: Wolters Kluwer; 2017.*
- *Netter FH. Atlas of human anatomy. 7th ed. Philadelphia: Elsevier; 2018.*
- *Tortora GJ, Derrickson BH. Principles of anatomy and physiology. 16th ed. Hoboken: Wiley; 2020.*
- *Weir J, Abrahams P. Imaging atlas of human anatomy. 6th ed. Philadelphia: Elsevier; 2020.*
- *Ellis H, Mahadevan V. Clinical anatomy: Applied anatomy for students and junior doctors. 14th ed. Chichester: Wiley Blackwell; 2019.*

Course Title: Cardiac Imaging	L	T	P	Cr.
Course Code: BRI5307	4	0	0	4

Total Hours: 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Manage complex research Question Answers and challenge established knowledge and praxis within cardiac imaging research.
2. Describe, plan and conduct independent research using noninvasivecardiac imaging methods.
3. Analyze and discuss scientific critics on a high level.
4. Communicate technical expertise and experience through presentationof own research.

Course Contents

UNIT-I **15 Hours**

Physiological aspects of cardiac imaging: Normal cardiac cycle Electrocardiography, Physiological anatomy of cardiac muscle, Mechanics of cardiac contraction, Physical basis for blood flow, pressure, and resistance.

UNIT-II **15 Hours**

Anatomy of the heart and great vessels, Normal morphology and structure, Segmental anatomy of the heart, Normal adult heart measurement, Techniques for imaging the heart and great vessels: Radiograph, Computed tomography, Magnetic resonance imaging, Cardiac scintigraphy (including PET), Other (working understanding).

UNIT-III **15 Hours**

Congenital heart disease: basic: Cyanotic versus acyanotic presentations Most common lesions, post-operative assessment of the following procedures: Most common indications for cardiac MRI in the setting of congenital and acquired pediatric cardiovascular disease, E. Situs anomalies (asplenia and polysplenia), Unusual congenital heart disease: advanced.

UNIT-IV **15 Hours**

Cardiomyopathy: Hypertrophic, Dilated, Restrictive (also infiltrative), Therapeutic and interventional options, Understand the measurements for dose – CTDI, CTDI 100, dose length product

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Skorton, D. J., Marcus, M. L., &Braunwald, E. (Eds.). (1996). Marcuscardiac imaging: a companion to Braunwald's heart disease (Vol. 2). Saunders.*
- *Boxt, L., &Abbara, S. (2015). Cardiac Imaging: The Requisites EBook.Elsevier Health Sciences.*

Course Title: Special Radiography Procedures II	L	T	P	Cr.
Course Code: BRI5308	4	0	0	4

Total Hours 60hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the principles and applications of digital fluoroscopy in special radiographic procedures
2. Describe the role of interventional radiology in minimally invasive therapeutic procedures
3. Describe the principles and applications of digital subtraction angiography (DSA)
4. Explain the imaging techniques used in cardiac catheterization and coronary angiography
5. Understand the complications and safety considerations in the administration of contrast media

Course Contents

UNIT-I **15 Hours**

Paediatric Imaging: special needs of patient and radiographer- use of dedicated equipment and accessories-modified technical considerations - selection of exposure factors-image quality considerations – radiation protection of the patient - special techniques in children for contrast studies.

Geriatric radiography Equipment and accessories – exposure factor considerations in special care. Elderly patients profile - difficulties during radiography – technical considerations-projections with unconventional special positioning.

UNIT-II **15 Hours**

- Female reproductive system: Hysterosalpingography.
- .Mammography related:
- Stereotactic biopsy, Specimen radiography, Wire localization, Ductography. Cyst puncture
- Arthrography: Shoulder, Hip, Knee, Elbow
- Sinography
- Fistulogram-
- Ductogram-

- Myelogram
- Sialogram

UNIT-III **15 Hours**

Basic angiography and DSA: History, technique, patient care, Percutaneous catherisation, catheterization sites, Asepsis, Guidewire, catheters, pressure injectors, accessories, Use of digital substraction- single plane and bi-plane Angiography: Carotid, cerebral and vertebral Angiography, Thoracic and Arch Aortography, Selective studies: Renal, SMA, Coeliac axis, Angiocardiography

UNIT-IV **15 Hours**

Venography: Peripheral venography, Cerebral venography, Inferior and superior venocavography, Spleno-venography. Interventional radiology techniques: PTC, PTBD, Fine needle aspiration, percutaneous nephrostomy, Catheter drainage Percutaneous balloon dilatation, stenting, embolization Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Bushberg JT, Seibert JA, Leidholdt EM Jr, Boone JM. The Essential Physics of Medical Imaging. 3rd ed. Lippincott Williams & Wilkins; 2012.*
- *Kaufman JA, Lee MJ. Vascular and Interventional Radiology: The Requisites. 2nd ed. Elsevier; 2013.*
- *Mettler FA. Essentials of Radiology. 3rd ed. Elsevier; 2019.*
- *Kuhl C, Truhn D. Digital subtraction angiography: Principles and techniques. EurRadiol. 2018;28(10):4376-4386.*
- *Kern MJ, Lerman A, Bech JW. Hemodynamic Rounds: Interventional Physiology for Clinical Practice. 3rd ed. Wiley-Blackwell; 2019*

Course Title: Physics of Radiotherapy	L	T	P	Cr.
Course Code: BRI5309	4	0	0	4

Total Hours: 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Identify medical radiation related instrumentation and apply techniques associated with diagnostic imaging & radiation oncology.
2. Compare theoretical, practical and professional information and communicate knowledge, ideas and procedures to other health care professionals/practioners, researchers and other key stakeholders.
3. Identify the biological effects of radiation and its application for radiation safety and for radiation treatment.
4. Classify radiation and radioactivity, its properties, units of measure, dosimetry measurement concepts and methods.

Course Contents

UNIT-I **15 Hours**

Radiation Units: Activity, Becquerel (Bq), exposure, Roentgen, absorbed dose, rad, Gray, dose-equivalent, rem, Sievert, KERMA. Relation between absorbed dose, exposure and KERMA. Calculation of absorbed dose from exposure, absorbed dose to air, absorbed dose to any medium, Bragg-Gray theory. Stopping power. Transfer of absorbed dose from one medium to another of photons, electrons. Exposure from radioactive sources, exposure rate constant

UNIT-II **15 Hours**

Dosimetric calculations: Dose calculation parameters, collimator scatter factor (Sc), phantom scatter factor (Sp), Tissue phantom ratio (TPR), tissue maximum ratio (TMR), and their influencing factors. Relationship between TMR and PDD.Scatter maximum ratio (SMR).

UNIT-III **15 Hours**

Isodose distribution of phantom beam: Isodosecharts, measurement of isodose curves, parameters of isodose curves: beam quality, source size, SSD and SDD – penumbra effect, collimation and flattening filter, field

size,Wedge filters: wedge angle, wedgetransmission factor, wedge systems, effect of beam quality, design of wedgefilters. Bolus, tissue compensators, shielding blocks.

UNIT-IV **15 Hours**

Electron beam therapy: Electron interactions, rate of energy less, collisional losses (ionization and excitation) radiation losses (bremsstrahlung), polarization, stopping power, absorbed dose, electron scattering, most probable energy, mean energy, energy at depth. Determination of absorbed dose, output calibration, phantom, reference depth and field size, absorbed dose calculation, depth dose distribution, central axis depth dose curves, isodose curves for different electron energies.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Symonds, P. P., Deehan, C., Meredith, C., & Mills, J. A. (2012). Walterand Miller's Textbook of Radiotherapy E-book: Radiation Physics, Therapy and Oncology. Elsevier Health Sciences.*
- *Pawlicki, T., Scanderbeg, D. J., &Starkschall, G. (2016). Hendee'sradiation therapy physics. John Wiley & Son*

6th SEMESTER

Course Title: Advance CT MRI and USG	L	T	P	Cr.
Course Code: BRI6350	3	0	0	3

Total Hours 45hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the physics of CT image acquisition, including dose optimization and reconstruction techniques.
2. Identify normal and pathological findings across different organ systems.
3. Explain MRI physics, pulse sequences, and relaxation times.
4. Differentiate tissue characteristics using various imaging protocols
5. Recognize limitations and artifacts in ultrasound imaging.

Course Contents

UNIT-I **10 Hours**

Helical CT scan: Slipring technology, advantages, multi detector array helical CT, cone–beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose.

UNIT-II **10 Hours**

MRI imaging methods–Head and Neck, Thorax, Abdomen, Musculo skeletal System imaging Clinical indications and contraindications-types of common sequences on imaging Protocols for various studies-slice section-patient preparation-positioning of the patient Plain studies-contrast studies-special procedures-reconstructions-3D images-MRS blood flow imaging, diffusion/perfusion scans-strength and limitations of MRI-role of radiographer.

UNIT-III **10 Hours**

Techniques of sonography-selection-Preparations- instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities-biopsy procedures, assurance to patients.

UNIT-IV **15 Hours**

CT of head and neck – thorax – abdomen – pelvis – musculo skeletal system – spine – PNS.Anatomy– clinicalindicationsandcontraindications– patientpreparation–technique–contrastmedia-types, dose, injection technique; timing, sequence - image display – patient care –utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Hendee WR, Ritenour ER. Medical Imaging Physics. 4th ed. New York: Wiley-Liss; 2002.*
- *Webb WR, Brant WE, Major NM. Fundamentals of Body CT. 5th ed. Philadelphia: Elsevier; 2021.*
- *Bushberg JT, Seibert JA, Leidholdt EM Jr, Boone JM. The Essential Physics of Medical Imaging. 3rd ed. Philadelphia: Wolters Kluwer; 2011.*
- *Haacke EM, Brown RW, Thompson MR, Venkatesan R. Magnetic Resonance Imaging: Physical Principles and Sequence Design. 2nd ed. Hoboken: Wiley; 2014.*
- *Buzug TM. Computed Tomography: From Photon Statistics to Modern Cone-Beam CT. Berlin: Springer; 2008.*

Course Title: Quality Assurance And Quality Control	L	T	P	Cr.
Course Code: BRI6351	4	0	0	4

Total Hours 60hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the Concepts of QA and QC – Differentiate between quality assurance and quality control in medical imaging and radiation therapy.
2. Explain QA/QC Procedures in Radiology – Identify key QC tests for X-ray, CT, MRI, ultrasound, and nuclear medicine systems.
3. Understand Image Quality Parameters – Assess factors such as contrast, resolution, noise, and artifacts in diagnostic imaging.
4. Perform Routine Quality Control Tests – Conduct performance evaluations of imaging equipment, including calibration and safety checks.
5. Evaluate Radiation Dose Optimization Techniques – Apply ALARA principles to minimize radiation exposure while maintaining diagnostic image quality.

Course Contents

UNIT-I **15 Hours**

Objectives of quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance. Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance.

UNIT-II **15 Hours**

Quality assurance programme at the radiological facility: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography; Computed tomography; Film processing,manual and automatic; Consideration for storage of film and chemicals; Faults

tracing; Accuracy of imaging-image distortion for digital imaging devices. LASER printer calibration, View box maintenance.

Quality assurance programme tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. Basic concepts of quality assurance – LASER printer - 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; Cassette leak check; Proper screen-film contact test; Safe light test; Radiation proof test; Field alignment test for fluoroscopic device; Resolution test; Phantom measurements - CT, US and MRI.

UNIT-III **15 Hours**

Quality assurance of film and image recording devices: Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion; Artifacts of films and image recording. Monitor calibration. SMPTE pattern.

Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.

UNIT-IV **15 Hours**

Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine -daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.

Quality Assurance and quality control of Modern Radiological and Imaging Equipment which includes Digital Radiography, Computed Radiography, CT scan, MRI Scan, Ultrasonography and PACS related. Image artifacts their different types, causes and remedies, Newer Radiation safety protocols and recent advances in radiation safety including AERB guidelines.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Bushong SC. Radiologic Science for Technologists: Physics, Biology, and Protection. 11th ed. St. Louis, MO: Mosby; 2020.*
- *Bushberg JT, Seibert JA, Leidholdt EM, Boone JM. The Essential Physics of Medical Imaging. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2011.*
- *Martin JE. Physics for Radiation Protection: A Handbook. 3rd ed. Weinheim: Wiley-VCH; 2013.*
- *Knoll GF. Radiation Detection and Measurement. 4th ed. Hoboken, NJ: John Wiley & Sons; 2010.*
- *Cember H, Johnson TE. Introduction to Health Physics. 5th ed. New York, NY: McGraw-Hill; 2009.*

Course Title: Research Publication ethics and IPR	L	T	P	Cr.
Course Code: BRI6352	4	0	0	4

Total Hours 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Define research misconduct (plagiarism, data fabrication, falsification).
2. Recognize ethical guidelines in publishing (ICMJE, COPE).
3. Identify the role of peer review and conflicts of interest
4. Differentiate between copyright, patents, and trademarks.
5. Understand open-access policies and licensing (Creative Commons, PubMed Central).

Course Contents

Unit I **15 Hours**

Scientific Writing: Structure of a scientific paper (Title, abstract, introduction, methodology, results, discussion, conclusion); Writing a research proposal: Objectives, methodology, expected outcomes, Academic writing style and language (Clarity, conciseness, and logical flow), Citation and referencing: Understanding various citation styles (APA, MLA, Chicago, etc.), Reference management tools.

Unit II **15 Hours**

Plagiarism: Types, plagiarism detection software, Publication misconduct and Publication Ethics, Plagiarism avoiding techniques, regulation of plagiarism in India; Publication Ethics: Integrity and Ethics, Best Practices, Intellectual Honesty & Research Integrity: Scientific Misconducts & Redundant Publications, Conflict of Interest, Publication Misconduct, Violation of Publication Ethics, Authorship and Contributorship; Identification of Publication Misconduct: Fabrication, Falsification and Plagiarism (FFP), Predatory Publishers & Journals.

Unit III **15 Hours**

Open Access Publishing: Concept of OER, Concept of open license, Open access publishing, Open access content management; Database and Research Metrics: Indexing Databases, Citation Databases: Web of Science, Scopus, Google Scholar, Metrics: h-index, g-ind, i10 index, Understanding Citation Metrics for Quality Research: Impact & Visualization Analysis; Peer Review and Journal Selection: Understanding the peer-review process, Types of journals: Open access vs. subscription-based journals, How to select a journal for publication, Writing a cover letter and responding to reviewer comments.

Unit IV **15 Hours**

Intellectual Property Rights (IPR): Definition and types of intellectual property (IP): Copyright, patents, trademarks, and trade secrets; The importance of IP in research and innovation, Historical development and international IP laws (e.g., the role of WIPO, TRIPS Agreement); Key IP terms: Patentable inventions, originality, novelty, and industrial applicability; Patents: Overview of the patent system: Types of patents, Steps involved in obtaining a patent: Application, examination, and grant, Patentability requirements: Novelty, non-obviousness, and usefulness, Patent infringement and enforcement; Licensing and Commercialization of IP: Types of IP licenses: Exclusive vs. non-exclusive licenses, Licensing agreements and revenue sharing, Commercialization of research findings: Startups, spin-offs, and patent exploitation, Technology transfer offices: Role in university-based IP commercialization; Patent issues in academic research: Balancing public knowledge with commercial interests, Ethical concerns in patenting research outcomes, Impact of IP laws on collaborative research, IP in publicly funded research.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *International Committee of Medical Journal Editors (ICMJE). Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals. Available at:* www.icmje.org
- *Committee on Publication Ethics (COPE). Ethical Guidelines for Peer*

Reviewers and Editors. Available at: https://publicationethics.org/

- *Wager E, Kleinert S. Responsible research publication: International standards for authors. Toxicology Letters. 2010; 197(3): 161-168.*
- *Hames I. Peer Review and Manuscript Ethics. The COPE Report 2013; 25–32.*
- *World Intellectual Property Organization (WIPO). Understanding Copyright and Patents. Available at:* https://www.wipo.int/
- *Das S. Intellectual Property Rights in Research & Academia. Journal of Academic Ethics. 2020;18(4): 345-358.*

Course Title: Advance CT MRI and USG Lab	L	T	P	Cr.
Course Code: BRI6353	0	0	2	1

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Evaluate contrast-enhanced CT and its indications, contraindications, and adverse reactions.
2. Explain the fundamental physics of MRI, including T1, T2 relaxation times, and pulse sequences.
3. Perform and interpret grayscale and Doppler ultrasound examinations for abdominal, vascular, musculoskeletal, and obstetric imaging
4. Interpret advanced MRI techniques, including functional MRI (fMRI), diffusion tensor imaging (DTI), and spectroscopy.
5. Differentiate between various CT scan protocols for neurological, thoracic, abdominal, and musculoskeletal imaging.

Course Contents

List of Practical's / Experiments: 30 Hours

1. Advanced X-ray Physics and CT Principles
2. Multi-detector CT (MDCT) and Dual-energy CT
3. Radiation Dose Optimization and ALARA Principles
4. Artifacts in CT and Correction Techniques
5. High-resolution CT (HRCT) in Chest and Interstitial Lung Disease
6. CT Angiography (CTA) and Perfusion Imaging
7. Dual-energy and Spectral CT in Oncologic Imaging
8. Cardiac CT: Protocols, Calcium Scoring, and Functional Imaging
9. Cardiac MRI: Techniques and Functional Assessment
10. Neuro MRI: Perfusion, Spectroscopy, and AI-assisted Analysis
11. Whole-body MRI in Oncology and Metastasis Screening
12. MSK MRI: Cartilage Mapping, Diffusion Imaging
13. Liver Elastography and CEUS in Liver Lesions
14. MSK and Nerve Ultrasound
15. USG in Critical Care and Emergency Radiology

Course Title: Indian Health Science	L	T	P	Cr.
Course Code: IKS0006	2	0	0	2

Total Hours 30 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand knowledge of India's traditional health systems
2. Critically analyse India's healthcare policies
3. Understand the patterns, causes, and effects of diseases in India and strategies for prevention and control.
4. Learn about nutrition, sanitation, mental health, and lifestyle diseases like diabetes and cardiovascular disorders, along with preventive healthcare measures.
5. Gain knowledge of traditional Indian medicine systems (e.g., Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homeopathy) alongside modern medical science.

Course Content

Unit – I: **7 Hours**

Introduction, Vedic foundations of Ayurveda. Ayurveda is concerned both with maintenance of good health and treatment of diseases.

Unit – II: **8 Hours**

Basic concepts of Ayurveda. The three Gunas and Three Doshas, Pancha-mahabhuta and Sapta-dhatu.

The importance of Agni (digestion). Six Rasas and their relation to Doshas. Ayurvedic view of the cause of diseases.

Unit – III: **8 Hours**

Dinacharya or daily regimen for the maintenance of good health. Ritucharya or seasonal regimen. Important Texts of Ayurveda. Selected extracts from *Astāngahrdaya*(selections from *Sūtrasthāna*)

and *Suśruta-Samhitā*(sections on plastic surgery, cataract surgery and anal fistula). The large pharmacopeia of Ayurveda.

Unit – IV: **7 Hours**

Charaka and Sushruta on the qualities of a Vaidya. The whole world is a teacher of the good Vaidya.

Charaka's description of a hospital. Hospitals in ancient and medieval India.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Park's Textbook of Preventive and Social Medicine – K. Park*
- *Ayurveda: The Science of Self-Healing – Dr. Vasant Lad*
- *Health Sector in India: A Policy Perspective – P. K. Pandey*
- *Essential Readings in Health Policy and Law – Joel B. Teitelbaum & Sara E. Wilensky*

Course Title: Basic Principle of Hospital Management	L	T	P	Cr.
Course Code: BRI6355	4	0	0	4

Total Hours 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Explain the fundamental concepts of hospital management and administration.
2. Describe the structure and functions of hospital departments and healthcare teams.
3. Analyze the principles of hospital operations, including patient flow, quality assurance, and accreditation.
4. Understand financial management, budgeting, and resource allocation in hospitals.
5. Evaluate the role of healthcare policies, ethics, and legal aspects in hospital administration.

Course Contents

UNIT-I **15 Hours**

Overview of Hospital Management

- Definition, Scope, and Importance
- Evolution of Hospital Systems
- Types of Hospitals (Public, Private, Teaching, Specialty)

Hospital Organization and Structure

- Organizational Hierarchy & Departments
- Roles & Responsibilities of Hospital Administrators

Hospital Planning and Infrastructure

- Hospital Design & Space Planning
- Essential Facilities & Equipment

Healthcare Policies & Regulations

- National & International Healthcare Systems
- Accreditation & Regulatory Bodies (NABH, JCI, WHO)

UNIT-II **15 Hours**

Human Resource Management in Hospitals

- Recruitment, Training & Performance Evaluation
- Employee Welfare & Labor Laws

Hospital Services & Patient Care

- Outpatient & Inpatient Services
- Emergency, ICU & Specialized Departments

Hospital Information System & Digital Health

- Electronic Health Records (EHR) & Telemedicine
- Health Informatics & AI in Healthcare

Quality Management & Patient Safety

- Healthcare Quality Standards (ISO, NABH)
- Risk Management & Infection Control

UNIT-III **15 Hours**

Financial Management in Hospitals

- Budgeting & Cost Control
- Revenue Cycle Management

Health Economics & Insurance

- Medical Billing & Coding
- Public & Private Health Insurance Systems

Legal & Ethical Issues in Hospital Management

- Medical Ethics & Patient Rights
- Hospital Laws & Legal Compliance

Medical Waste Management & Sustainability

- Bio-Medical Waste Disposal Guidelines
- Green Hospital Initiatives

UNIT-IV **15 Hours**

Leadership & Communication in Healthcare

- Leadership Styles in Healthcare
- Conflict Resolution & Team Management

Strategic Planning & Decision-Making

- SWOT Analysis in Healthcare
- Hospital Marketing & Branding

Disaster & Crisis Management in Hospitals

- Emergency Preparedness & Response
- Hospital Safety & Security

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Griffith JR, White KR. The Well-Managed Healthcare Organization. 9th ed. Chicago: Health Administration Press; 2019.*
- *Chandra A, Ghosh S, Jain S. Principles of Hospital Administration and Planning. 3rd ed. New Delhi: Jaypee Brothers Medical Publishers; 2021.*
- *Shi L, Singh DA. Essentials of the US Health Care System. 6th ed. Burlington: Jones & Bartlett Learning; 2022.*
- *Gupta SK. Hospital Administration and Human Resource Management. 2nd ed. New Delhi: Jaypee Brothers Medical Publishers; 2017.*
- *McKee M, Healy J. Hospitals in a Changing Europe. Philadelphia: Open University Press; 2002.*

Course Title: Mentoring and Professional development	L	T	P	Cr.
Course Code: BRI6356	4	0	0	4

Total Hours: 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Provide appropriate first Aid for minor injuries including small cuts, grazes, bruises etc.
2. Assess situations and circumstances in order to provide First Aid safely, promptly and effectively in a range of emergencies.
3. Manage organizations, recordsrelated to patients and departmental statistics.
4. Administer First Aid to an adult who is choking.

Course Contents

UNIT-I **15 Hours**

First aid: Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus; drug reactions;prophylactic measures; administration of oxygen; electric shock; burns; scalds; haemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons.

UNIT-II **15 Hours**

Infection: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; Asepsis and antisepsis. Universalprecautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc.

UNIT-III **15 Hours**

Principles of Asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filament swabs, elementary operating theatre procedure; setting of trays and trolleys in the radio imaging department (for study by radio imaging students only)

UNIT-IV **15 Hours**

Departmental procedures: Department staffing and organizations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department;

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Curry, T. S., Dowdey, J. E., & Murray, R. C. (1990). Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins.*
- *Podgoršak, E. B. (2006). Radiation physics for medical physicists (Vol.1). Berlin: Springer.*
- *Weishaupt, D., Köchli, V. D., &Marincek, B. (2008).How does MRI work?: an introduction to the physics and function of magnetic resonance imaging. Springer Science & Business Media*

Course Title: CT and MRI Protocols	L	T	P	Cr.
Course Code: BRI6357	4	0	0	4

Total Hours 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Understand the fundamental principles of CT and MRI imaging.
2. Learn detailed protocols for various clinical applications.
3. Gain knowledge of patient preparation, contrast use, and safety measures.
4. Develop skills in optimizing image quality and troubleshooting artifacts.
5. Interpret basic CT and MRI images with a focus on pathology detection.

Course Contents

UNIT-I **15 Hours**

CT Basics

- Principles of CT imaging
- X-ray attenuation and Hounsfield Units
- CT scanner generations and technology updates
- Image reconstruction techniques (Filtered Back Projection, Iterative Reconstruction)

MRI Basics

- Principles of MRI
- Pulse sequences (Spin Echo, Gradient Echo, Fast Spin Echo, Inversion Recovery)
- T1, T2, and Proton Density contrast mechanisms
- MRI hardware and coils

Safety Considerations

- Radiation dose in CT and ALARA principle
- MRI safety zones and contraindications
- Gadolinium-based contrast safety

UNIT-II **15 Hours**

Neuroimaging Protocols

- Routine brain CT
- Stroke protocol (Non-contrast, CT Perfusion, CT Angiography)
- Spine CT (trauma, degenerative diseases)

Chest & Cardiovascular CT

- HRCT for interstitial lung disease
- Pulmonary embolism CT angiography
- Coronary CT angiography

Abdominal & Pelvic CT

- CT for liver, pancreas, and kidney pathologies
- CT urography and enterography
- Trauma and emergency protocols

Musculoskeletal CT

- CT for fractures and post-operative assessment
- 3D CT reconstruction techniques

UNIT-III **15 Hours**

Neuro MRI Protocols

- Routine brain MRI sequences
- Stroke MRI (DWI, PWI, MRA)
- Spine MRI (Degenerative, Infectious, Tumor)

Cardiac & Vascular MRI

- Cardiac MRI techniques (Cine, Perfusion, Delayed Enhancement)
- MRA for vascular pathologies

Abdominal & Pelvic MRI

- Liver MRI (Fat suppression, Diffusion, MRCP)
- Prostate MRI (PI-RADS)

- Female pelvis MRI (Fibroids, Endometriosis)

Musculoskeletal MRI

- Sports injury MRI protocols
- Bone marrow and soft tissue tumor MRI

UNIT-IV **15 Hours**

Advanced Techniques

- Dual-Energy CT
- Functional MRI (fMRI)
- Diffusion Tensor Imaging (DTI)
- MR Spectroscopy

Protocol Optimization & Troubleshooting

- Reducing motion and metal artifacts
- Choosing optimal contrast agents
- Improving spatial and temporal resolution

Case-Based Learning & Practical Applications

- Review of real patient cases
- Identifying common errors and pitfalls
- Clinical decision-making using CT/MRI

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Haaga JR, Boll DT. Computed Tomography & Magnetic Resonance Imaging of the Whole Body. 6th ed. Philadelphia: Elsevier; 2016.*
- *Bushberg JT, Seibert JA, Leidholdt EM, Boone JM. The Essential Physics of Medical Imaging. 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2011.*
- *Mannudeep K, Mahesh M. Principles of Radiographic Imaging: An Art and a Science. 5th ed. Clifton Park: Delmar Cengage Learning; 2013.*

- *Pinto A, Reginelli A, Pinto F, et al. "Imaging of Emergency: A Practical Guide to Radiologic Diagnosis." Springer; 2014.*
- *Smith HJ, Adam EJ, Dixon AK. Grainger & Allison's Diagnostic Radiology: A Textbook of Medical Imaging. 5th ed. London: Churchill Livingstone; 2008.*

Course Title: Orientation in Clinical Sciences	L	T	P	Cr.
Course Code: BRI6358	4	0	0	4

Total Hours: 60 hrs

Learning Outcomes: After completion of this course, the learner will be able:

1. Demonstrate the ethical principles in healthcare, including patient autonomy, confidentiality, informed consent, and maintaining professional behavior and boundaries in a clinical setting.
2. Familiarize the students with the healthcare system.
3. Explore different medical specialties: This objective aims to expose students to various medical specialties and subspecialties.
4. Develop basic clinical skills such as taking patient histories, conducting physical examinations, and practicing basic clinical procedures like vital sign measurement or wound dressing.

Course Contents

UNIT-I **15 Hours**

Medicine: Pericarditis, Valvular diseases, Rheumatic Heart Disease, Heart failure, Chronic Bronchitis, Emphysema, Brochitis, Pneumonia, Tuberculosis, Pleura effusion, Empyema.

UNIT-II **15 Hours**

Aclasia cardia, Peptic ulcer, Intestinal obstruction, Crohn's disease, Ulcerative colitis, Pancreatitis, Portal Hypertension, Ascitis, Cirrhosis, Cholecystitis.

UNIT-III **15 Hours**

UTI: Glomerulo nephritis, Nephrotic Syndrome, Urinary calculi Polycystic Kidney disease, Cerebral Vascular Disorders, Meningitis, Encephalitis.

UNIT-IV **15 Hours**

Pathology: Inflammation, Neoplasia, Osteomyelitis, Fractures, Osteoporosis, Rickets, Spontaneous Phenumo thorax.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer.

Suggested readings:

- *Agha, A., & Thompson, J. (2020). The Impact of Orientation Programs on Clinical Skills Development. Journal of Medical Education, 45(2), 127-135.*
- *Bell, K., & Anderson, L. (2019). Effective Strategies for Orientation in Clinical Sciences. Clinical Education Review, 15(3), 67-82.*
- *Carter, S., & Johnson, R. (2018). The Role of Orientation in Clinical Sciences: A Comparative Study. Journal of Health Professions Education,30(4), 209-216.*
- *Davis, M., & Smith, P. (2017). Best Practices in Orientation for Clinical Sciences: A Literature Review. Journal of Medical Education and Training, 25(1), 45-57.*
- *Henderson, C., & Brown, L. (2016). The Importance of Orientation in Clinical Sciences: Perspectives from Clinical Educators. Medical Teacher, 38(9), 912-919*