GURU KASHI UNIVERSITY

Bachelor of Science

in

Radiology & Imaging Technology

Session: 2022-23

Department of Paramedical Sciences

Program Learning Outcomes (POs): After completion of the program the Bachelors students will be able to

- To Provide the knowledge of X-RAY, CT, DEXA scan, USG, and MRI to the solution of diagnosis.
- To **i**dentify the problem, investigate the problem-formulate viable solutions to the problem in the classroom and laboratory students are given the freedom to develop alternative ideas.
- **3.**To design solutions for complex radio-diagnosis problems and design system components or process that meet the specified needs with appropriate consideration for the public health & safety**.**
- To use research based knowledge and research methods including design of experiments analyses and interpretation of data, and synthesis of information to provide valid conclusion.
- To create, select and apply appropriate techniques.
- To apply reasoning informed by the contextual knowledge to assess societal, health safety legal and cultural issues and the consequent responsibilities relevant to the professional radiology practice.
- To understand the impact of the professional radio diagnosis solution in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
- To apply ethical principles and commit to professional ethics and responsibilities and need for sustainable development.

Programme Structure

Semester -1st							
S. No	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	BRI101	General Anatomy	Core course	4	0	0	4
2	BRI102	General Physiology	Core course	4	0	0	4
3	BRI103	Applied physics	Core course	4	0	0	4
4	BRI104	General Anatomy (Practical)	Technical skills	0	0	4	2
5	BRI105	General Physiology (Practical)	Technical skills	0	0	4	2
6	BRI106	Applied physics (Practical)	Technical skills	0	0	4	2
7	BRI107	Drug Abuse; problem, management & prevention	Ability Enhancement Course	4	0	0	4
8	BRI108	Basic Computer & Information science	Technical Skills	0	0	4	2
			TOTAL	**16**	**0**	**16**	**24**

Semester -2nd							
S. No	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	BRI201	Conventional Radiography &equipment	Core Course	4	0	0	4
2	BRI202	Image acquisition processing &achieving	Core Course	4	0	0	4
	Disciplinary Elective (Any one of the following)						
3	BRI203	Medical Ethics & Legal aspects	Disciplinary Elective	3	0	0	3
4	BRI204	Introduction to quality & patient safety					
	Disciplinary Elective (Any one of the following)						
5	BRI205	English & communication skills	Disciplinary Elective	3	0	0	3
6	BRI206	Environment studies					
7	BRI207	Survey paper	Research based skills	3	0	0	3
8	BRI208	Conventional Radiography &equipment (Practical)	Technical skills	0	0	6	3
9	BRI209	Image acquisition processing &achieving (Practical)	Technical skills	0	0	6	3
			TOTAL	**17**	**0**	**12**	**23**

Semester -3rd							
S. No	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	BRI301	Clinical Radiography Positioning-I	Core course	4	0	0	4
2	BRI302	Modern radiological & imaging equipment including physics	Core course	4	0	0	4
3	BRI303	Contrast & special Radiography procedures	Core course	4	0	0	4
	Disciplinary Elective (Any one of the following)						
4	BRI304	Basic physics include radiological physics	Disciplinary Elective	3	0	0	3
5	BRI305	Basic principles of Hospital Management					
	Disciplinary Elective (Any one of the following)						
6	BRI306	Remedial Biology	Disciplinary Elective	3	0	0	3
7	BRI307	Remedial Mathematics					
8	BRI308	Clinical Radiography Positioning-I (Practical)	Technical skills	0	0	6	3
9	BRI309	Modern radiological & imaging equipment including physics (Practical)	Technical skills	0	0	6	3
10	BRI310	Contrast & special Radiography procedures (Practical)	Technical skills	0	0	6	3
11	BRI311	Research Methodology, Biostatistics & IPR	Research Based Skills	3	0	0	3
			TOTAL	**21**	**0**	**18**	**30**

Semester -4th							
S. No	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	BRI401	Clinical Radiography Positioning-II	Core Course	4	0	0	4
2	BRI402	Physics of newer imaging modalities	Core Course	4	0	0	4
Disciplinary Elective (Any one of the following)							
3	BRI405	Quality control in Radiology and patient safety	Disciplinary Elective	3	0	0	3
4	BRI406	Disaster management					
Value added Courses							
5	BRI407	Fundamentals of Nursing	Value Added Course	2	0	0	2
6	BRI408	Clinical Radiography Positioning-I (Practical)	Technical skills	0	0	6	3
7	BRI409	Physics of newer imaging modalities (Practical)	Technical skills	0	0	6	3
Open Elective (For other departments)							
8			Open Elective Course	3	0	0	3
			TOTAL	**18**	**0**	**12**	**25**
Open Elective (For other departments)							
10	BRI403	Newer modalities imaging techniques including patient care	Open Elective	3	0	0	3
11	BRI404	Physics of Radiotherapy					

Semester -5th							
S. No	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	BRI501	Cross sectional anatomy & physiology	Core Course	4	0	0	4
2	BRI502	Radiographic techniques of advanced imaging technology	Core Course	4	0	0	4
	Disciplinary Elective (Any one of the following)						
3	BRI503	Physics of advance imaging technology	Disciplinary Elective	3	0	0	3
4	BRI504	Cardiac Imaging					
Disciplinary Elective (Any one of the following)							
5	BRI505	Hospital practice & patient care	Disciplinary Elective	3	0	0	3
6	BRI506	Regulatory Requirements in Diagnostic Radiology & its Imaging Act and Rules.					
7	BRI507	Introduction to Health Care System	Ability Enhancement	3	0	0	3
8	BRI508	Cross sectional anatomy & physiology (Practical)	Technical skills	0	0	6	3
9	BRI509	Radiographic techniques of advanced imaging technology (Practical)	Technical skills	0	0	6	3
			TOTAL	**17**	**0**	**12**	**23**

Semester 6th							
S. No	**Course Code**	**Course title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	BRI601	Training/internship report	Technical skills	0	0	0	20
			Total	**0**	**0**	**0**	**20**

Evaluation Criteria for Theory Courses

A. Continuous Assessment: [25 Marks]

i. Surprise Test (Two best out of three) - (10 Marks)

ii. Term paper (10 Marks)

iii. Assignment(s) (10 Marks)

iv. Attendance (5 marks)

B. Mid Semester Test-1: [30 Marks]

C. MST-2: [20Marks]

D. End-Term Exam: [20 Marks]

Evaluation Criteria for other courses has been given separately with the Respective courses

Semester-I

Course Title: General Anatomy
Course Code: BRI101

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the students, will be able to

Course contents

1. Learn clinical scenarios, the concepts and knowledge of the general terminology, cell structure and function, histology, gross anatomy, and physiology of several organ systems (integumentary, skeletal, muscular, and nervous).
2. Explain interrelationships among molecular, cellular, tissue, and organ functions in each system.
3. Design the knowledge of Identification &Descriptiction of Anatomical aspects of muscle bones & joints, & to understand and Analyze movements
4. Identify & describe various structures of the Cardiovascular, Digestive & Respiratory system & the course of blood vessels.
5. Analyze the Anatomical basis of various clinical conditions.

UNIT-I **15 Hours**

1. **Introduction to Human Anatomy and Physiology**: General organization Synopsis of all systems

2**. Cell Organization and Function**: Structure & function of all cell organelles-cell division (Mitosis and meiosis)

3. **Tissues** (Definition, classification with structure and function)

UNIT-II **16 Hours**

4. **Blood:** Functions of blood, composition of blood, plasma& its functions. - Blood clotting (mechanism, clotting factors)

5. **Human Body Skeletal System**: Structure and function of all individual bones and joints movement of joints, skeletal muscles

UNIT-III **18 Hours**

6. **Respiratory System:** Structure of respiratory pathway, function of respiratory tract, cough reflex, intrapleural pressure, mechanism of breathing and respiration, muscles of respiration, vital capacity, tidal volume, inspiration, reserve volume and residual volume.

7. **Cardiovascular System** - Anatomy and Physiology of Heart - Blood circulation - Arteries and veins - Conductive system of Heart - Cardiac cycle - Introduction to ECG

UNIT-IV **11 Hours**

8. **Lymphatic System -** Introduction - Structure and function - Lymph nodes - Spleen - Thymus gland, Tonsils

9. **Structure and Function of Sense Organs** - Eye - Ear - Nose – Tongue

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Books

1. Ashalatha, P. R., &Deepa, G. (2012). *Textbook of Anatomy & Physiology for Nurses*. JP Medical Ltd.
2. Chaurasia, B. D. (2004). *Human anatomy* (p. 53). CBS Publisher.
3. Listinsky, J. J. (1987). The Anatomy Workbook. *Radiology*, *164*(1), 78-78.
4. Waugh, A., & Grant, A. (2014). *Ross & Wilson Anatomy and physiology in health and illness.* Elsevier Health Sciences.

5. Netter, F. H. (2014). *Atlas of human anatomy, Professional Edition*. Elsevier health sciences.

Course Title: General Physiology
Course Code: BRI102

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the students will be able to,

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 Muskelo-skeletal, Neuro-motor, Cardio-respiratory, Endocrine, Uro-genital function, & alterations in function with aging
4. Determine Properties of nerve fibers, function of neuroglia, synapse, CNS, CSF, brain, cranial nerves, demonstration of reflexes.
5. Learn the skills of basic clinical examination, with special emphasis to Peripheral & Central Nervous system, Cardiovascular & Respiratory system, & Exercise

Course Contents

UNIT-I **11 Hours**

Introduction to physiology of the human body –Composition of body, Homeostasis, Introduction to chemistry of life.

Organization of the human body at the cellular level – Function of lipids, carbohydrates, proteins & cell organelles.

Organization of the human body at the tissue level – Function of Epithelial, Connective, Muscular & Nervous tissues.

UNIT-II **16 Hours**

Blood – Haemopoiesis, homeostasis, coagulation of blood, blood transfusion.

Lymphatic System – Function of lymph vessels, lymphatic tissue & organs, lymphatic's, spleen, tonsil, and thymus.

Resistance & Immunity – Innate immunity, acquired immunity, humoral & cell mediated immunity.

UNIT-III **15 Hours**

Nervous System – Properties of nerve fibers, function of neuroglia, synapse, CNS, CSF, brain, cranial nerves, demonstration of reflexes.

Muscular System – Properties of skeletal muscle, cardiac muscle, smooth muscle, muscles of the body.

Skeletal System – Functions of bones, axial skeleton, and appendicular skeleton.

Musculoskeletal System – Movement in the joints of upper & lower limb**.**

UNIT-IV **18 Hours**

Respiratory System – Physiology of respiration, pulmonary function tests, gas exchange in lungs, transport of gases between lungs & tissues, regulation of respiration.

Cardiovascular System - Heart & blood vessels: Systemic circulation, pulmonary circulation, ECG, cardiac output, blood pressure.

Digestive System – Process of digestion, function of oral cavity, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, liver, gallbladder, pancreas.

Urinary System – Function of kidneys, juxtaglomerular apparatus, Ureter, urinary bladder, urethra, physiology of urine formation, Glomerular filtration, tubular reabsorption, water balance, and micturation.

Introduction to Genetics - Features of chromosomes, DNA, protein synthesis, dominant inheritance, recessive inheritance, and sex linked inheritance.

Reproductive System– Female: Physiology of female reproductive system.

Reproductive System – Male: Physiology of male reproductive system.

Endocrine System - Mechanism of action of hormones, function of pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas.

Special Senses - Physiology of olfaction, taste, hearing, balance & vision.

Skin – Function of skin, hair, sebaceous glands, sweat glands, nails, temperature regulation.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Ashalatha, P. R., &Deepa, G. (2012). *Textbook of Anatomy & Physiology for Nurses*. JP Medical Ltd.
2. Guyton, A. C., & Hall, J. E. (2006). Medical physiology. *Gökhan N, Çavuşoğlu H (Çeviren), 3*.
3. Waugh, A., & Grant, A. (2014). *Ross & Wilson Anatomy and physiology in health and illness*. Elsevier Health Sciences.
4. Sembulingam, K., &Sembulingam, P. (2012). *Essentials of medical physiology*. JP Medical Ltd.

Course Title: Applied Physics
Course Code: BRI103

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the students will be able to

1. Understand the nature and propagation of sound waves (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction, Ultrasonic waves, Doppler effect
2. Explain Heat capacity, specific heat capacity, Heat transfer-conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion
3. Learn Introduction to magnetic Circuits-Simple magnetic Circuits-Faraday's laws, induced emf and inductance's, Galvanometer. Magnets and magnetic field, force on an electric current in a magnetic field, force on electric charge moving in a magnetic field.
4. Discuss magnetic field due to straight wire; force between two parallel wires, Ampere's law, electromagnet and solenoids.
5. Evaluate Application of Faraday's laws, induced EMFs and inductance's, Galvanometer.

Course Contents

UNIT-I **15 Hours**

Basic Physics: Sound -The nature and propagation of sound wave (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction, Doppler's effect

Heat: Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer-conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion.

UNIT-II **18 Hours**

Fundamentals Of Dc Circuits: Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, resistivity, series and parallel combination, Voltage-Current relations for resistor, inductor, capacitor, Kirchhoff's laws, EMF.

Ac Circuits: A.C. and D.C. power supply with examples, single phase and poly phase power supply, Sinusoidal, Introduction to three phase systems - types of connections, relationshipbetween line and phase values.

UNIT-III **16 Hours**

Magnetic Circuits: Introduction to magnetic Circuits-Simple magnetic Circuits-Faraday's laws, induced emf and inductances, Galvanometer. Magnets and magnetic field, force on an electric current in a magnetic field, force on electric charge moving in a magnetic field, magnetic field due to straight wire; force between two parallel wires, Ampere's law, electromagnet and solenoids

UNIT-IV **11 Hours**

Rectification: Wave form of half wave and full wave current/voltage wave form; Rectifiers: Introduction, energy bands in solids, the semiconductor, p-type and n-type semiconductors, p-n junction, p-n junction diode, p-n junction diode as rectifier (half- wave and full-wave rectifier), rectifiers relative merits and demerits; silicon, germanium diodes.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1.Stanton, L. (1969). BASIC MEDICAL RADIATION PHYSICS.

2.Fundamental of X-ray and Radium Physics - Joseph Selman

3.Debnath, J. (2016). Textbook of radiology for residents and technicians. *Astrocyte*, *2*(4), 221-221.

4.Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990). *Christensen's physics of diagnostic radiology*. Lippincott Williams & Wilkins.

5.Allisy-Roberts, P. J., & Williams, J. (2007). *Farr's physics for medical imaging*. Elsevier Health Sciences.

Course Title: General Anatomy (Practical)
Course Code: BRI104

L	T	P	Cr.
0	0	4	2

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Learn the demonstration of basic anatomical terminology, anatomical position, anatomical planes, levels of organization in the body, organ systems, skeleton, and cavities of the body.
2. Evaluate Features of lymph vessels, lymphatic tissue & organs, lymphatic's, spleen, tonsil, thymus
3. Study Central nervous system, brain, cerebellum, spinal cord, cranial nerves, and autonomic nervous system.
4. Differentiate Skeletal muscle, cardiac muscle, smooth muscle.
5. Discuss Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas.

Course Contents

Basic Anatomical Terminology, Anatomical Position, Anatomical Planes, Levels of Organization in the Body, Organ Systems, Skeleton, Cavities of the Body.

Lymphatic System - Features of lymph vessels, lymphatic tissue & organs, lymphatic's, spleen, tonsil, and thymus.

Nervous System - Central nervous system, brain, cerebellum, spinal cord, cranial nerves, autonomic nervous system.

Muscular System - Skeletal muscle, cardiac muscle, smooth muscle, muscles of the body.

Skeletal System - Features of bones, axial skeleton, and appendicular skeleton.

Musculoskeletal System - Joints of upper & lower limb.

Respiratory System - Nose & paranasal sinuses, pharynx, larynx, trachea, lungs.

Cardiovascular System - Heart & blood vessels.

Digestive System - Oral cavity, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, liver, gallbladder, pancreas.

Urinary System - Kidneys, juxtaglomerular apparatus, Ureter, urinary bladder, urethra.

Introduction to Genetics - Features of chromosomes, DNA.

Reproductive System In Females - External & internal genital organs, breast.

Reproductive System In Males - Penis, scrotum, testes, prostate gland.

Endocrine System - Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Agur, A. M., &Dalley, A. F. (2009).*Grant's atlas of anatomy*. Lippincott Williams & Wilkins.

Course Title: General Physiology (Practical)
Course Code: BRI105

L	T	P	Cr.
0	0	4	2

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Apply Basic practical skills on blood testing, Microscope, haemocytometer and RBC count
2. Learn the functions of important physiological systems including the cardio-respiratory, renal, reproductive and metabolic systems.
3. Gain knowledge of Clinical examination of respiratory system and digestive system.
4. Measure blood pressure and pulse rate
5. Perform, analyze and report on experiments and observations in Examination of urine.

Course Contents

Blood test:

1. Microscope
2. Haemocytometer
3. Blood
4. RBC count
5. Hb
6. WBC count
7. Differential Count
8. Hematocrit demonstration
9. ESR
10. Blood group & Rh. Type
11. Bleeding time and clotting time.

Digestion

Test salivary digestions

Excretion

1. Examination of Urine
2. Specific gravity
3. Albumin

4. Sugar

5. Microscopic examination for cells and cysts

Respiratory System:

1. Clinical examination of respiratory system

2. Spirometry

3. Breath holding test

Cardio Vascular System:

1. Measurement of blood pressure and pulse rate

2. Effect of exercise on blood pressure and pulse rate

Suggested Readings

1. Peate, I., & Nair, M. (2015).*Anatomy and Physiology for Nurses at a Glance*.John Wiley & Sons.

Pal, G. K. (2006).*Textbook Of Practical Physiology-2Nd Edn*. Orient Blackswan.

Course Title: Applied Physics (Practical)
Course Code: BRI106

L	T	P	Cr.
0	0	4	2

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

Measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multimeter.

Draw the diagram of a given open circuit comprising at least a battery, resistor/rheostat, key, ammeter and voltmeter

Learn fundamentals of Magnetism

Study rectification & types of Rectification

Compare and Contrast AC &DC circuits.

Course Contents

Demonstration Of

Basic Physics

Sound

Heat

Fundamentals of Dc Circuits

Ac Circuits

Magnetic Circuits

Rectification

Suggested Readings

1. Bushong, S. C., &Facmp, S. F. (2020).*Radiologic Science for Technologists E-Book: Physics, Biology, and Protection*. Mosby.
2. Huda, W., & Slone, R. M. (2003).*Review of radiologic physics*. Lippincott Williams & Wilkins.
3. Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990).*Christensen's physics of diagnostic radiology*. Lippincott Williams & Wilkins

Course Title: Drug Abuse; problem, management & prevention

Course Code: BRI107

L	T	P	Cr.
4	0	0	4

Total Hours 30

Course Learning Outcomes: On completion of this course, the students will be able to

1. Gain knowledge about detrimental impacts of drug on health & relations.

2. Become aware about the physiological and sociological causes of drug abuse.

3. Acquire knowledge about types of drugs.

4. Asses knowledge about management and prevention of drug abuse.

5. Describe the concept of drug abuse and their impact on public health.

Course Contents

UNIT-I **8 Hours**

Problem of drug abuse: Concept and Overview; types of drug often abused.

Introduction to drugs of abuse: Short term, long term effects & withdrawal symptoms

Stimulants: Amphetamines, Cocaine, Nicotine

Depressants: Alcohol, Barbiturates – Nembutal, Seconal, Phenobarbital Benzodiazepines, Dizaepam, Alprazolam, Flunitrazepam

Narcotics: Opium, Morphine, Heroin

Hallucinogens: Cannabis & derivatives, steroids and inhalants

UNIT-II **7 Hours**

Nature of the Problem: Vulnerable Age Groups, Signs & symptoms of Drug Abuse

1. Physical indicators

2. Academic indicators

3. Behavioral & Psychological indicators

UNIT-III **8 Hours**

Causes and Consequences of Drug Abuse

Causes:

1. Physiological

2. Psychological

3. Sociological

Consequences of Drug Abuse:

1. For individuals

2. For families

3. For society and nation

UNIT-IV **7 Hours**

Management & Prevention of Drug Abuse

1. Management of Drug Abuse

2. Prevention of Drug Abuse

3. Role of Family, School, Media, Legislation & De-addiction centers**.**

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Kapoor. T., Drug Epidemic among Indian Youth, Mittal Pub, New Delhi.

4. Ahuja, Ram, Social Problems in India, Rawat Publications, Jaipur, 2003.

Course Title: Basic in Computers and Information Science (Practical

Course Code: BRI108

L	T	P	Cr.
0	0	4	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students would be able to

1. Understand the concepts of computer system, Windows operating system, Internet, various storage devices and computer Networks, e-waste
2. Analyze various components and Input output devices used in a computer system.
3. Utilize various applications and software's used
4. Creating and manipulating presentation, views, formatting and enhancing text, and slide with graphs
5. Investigate Various applications used in Clinical Setting.

Course Contents

Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.

Introduction of Operating System: introduction, operating system concepts, types of operating system.

Computer networks: introduction, types of network (LAN, MAN, WAN, Internet,

Intranet), network topological (star, ring, bus, mesh, tree, hybrid), componen ts of network.

Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer

Protocol, telnet, the World Wide Web (WWW)), WWW browsers, use of the int ernet.

Application of Computers in clinical settings.

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Schneider, G. M., &Gersting, J. (2018).*Invitation to computer science*. Cengage Learning.
2. Goel, A. (2010). *Computer fundamentals*. Pearson Education India.
3. Dandamudi, S. P. (2003). *Fundamentals of computer organization and design* (Vol. 7). New York: Springer

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.).

Introduction to Computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.

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.

Transactional modes

Course Title: : Conventional Radiography and Equipment's

Course Code: BRI201

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the students will be able to,

1. Explain Production of X-rays: X-ray tube, construction working and limitation.

2. Understand rotating anode & stationary anode x - ray tube.
3. Gain knowledge about anode voltage and filament temperature; continuous and characteristics spectrum of x - rays, inherent filter and added filter.
4. Learn basics of the H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit
5.Describe working and use of relays in diagnostic machines for over load protection.

Course Contents

UNIT-I **12 Hours**

Production of X-Rays: X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anode x - ray tube; construction, working, methods of cooling the anode, rating chart and cooling chart; rotating anode x - ray tube: construction, working rating chart, speed of anode rotation, angle of anode inclination, dual focus and practical consideration in choice of focus, anode heel effect, grid controlled x - ray tube; 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.

UNIT-II **16 Hours**

High Tension Circuits: H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment; mains voltage compensator, mains resistance compensator, compensation for frequency variation, control of tube voltage, kV compensator; high tension selector switch, filament circuit, control of tube current, space charge compensation.

Meters and Exposure Timers: Moving coil galvanometer: construction and working/conversion to millimeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimeter, digital panel meters. Clockwork timers, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber based timers, integrated timer. 4. Interlocking circuits: Relays: description and working, use of relays in diagnostic machines for over load protection, circuit diagram; simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.

UNIT-III **14 Hours**

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, gridded cassettes, stationary and moving grid potter Bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocator movement.

UNIT-IV **18 Hours**

Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualizing intensified image, basic principles of closed circuit television camera and picture tube. Vision camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid controlled x-ray tube.

Care and Maintenance of X-ray Equipment; General care; functional tests; testing the performance of exposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1.Stanton, L. (1969). Basic Medical Radiation Physics.

2.Fundamental of X-ray and Radium Physics - Joseph Selman

3.Debnath, J. (2016). Textbook of radiology for residents and technicians. *Astrocyte*, *2*(4), 221-221.

4.Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990). *Christensen's physics of diagnostic radiology*. Lippincott Williams & Wilkins.

Course Title: : Image acquisition processing and archieving

Course Code: BRI202

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1.Discuss Composition of single and double coated Radiographic films, Screen &Non Screen films, structure of film, characteristic curve, X Ray Film Characteristics (speed, base, fog, gamma, latitude).

2. Compare & contrast Effect of grain size on film response to exposure, interpretation of characteristics curve, latent image formation, process of film developing (composition of developer, Fixer and other processing solution)

3. Explain the film storage rules and guidelines, film handling and care (size, construction and function)

4. Study Radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur Radiographic illuminators and viewing conditions.

5. Plan layout of dark room, location of dark room, entrance, pass box, hatch, hangers, safe light, criteria of safe light, safe light test.

Course Contents

UNIT-I **18 Hours**

Composition of Single and Double Coated Radiographic Films, Screen &Non Screen films, structure of film, characteristic curve. characteristics (speed, base + fog, gamma, latitude), effect of grain size on film response to exposure, interpretation of characteristics curve, latent image formation, process of film developing (composition of developer, Fixer and other processing solution), common errors and faults while processing (densitometer), automatic processing unit (processing cycle), developer & Fixer replenishment and silver recovery.

UNIT-II **12 Hours**

Film Storage Rules And Guidelines, film handling and care (size, construction and function), types of intensifying screens and relative advantage, loading and unloading of cassettes and their care/maintenance, effects of kV and mA on variation of emitted radiation intensity, determination of relative speeds, film contrast, film screen contact.

UNIT-III **16 Hours**

Using Developer, Fixer, Rinser components, and Replenisher. Manual technique of developing film, Automatic film processor, common errors in processing.

Meaning of radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur, radiographic illuminators and viewing conditions, visual acuity and resolution, quality assurance of the related equipment and its benefits with respect to visual assessment

UNIT-IV **12 Hours**

Introduction, purpose and location of dark room, layout of dark room, entrance, pass box, hatch, hangers, safe light, criteria of safe light, safe light test.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Bushong, S. C., &Facmp, S. F. (2020). *Radiologic Science for Technologists E-Book: Physics, Biology, and Protection*. Mosby.
2. Chesney, D. N., & Chesney, M. O. (1981). Radiographic imaging
3. Gregory, P. (Ed.). (1996). *Chemistry and technology of printing and imaging systems* (p. 260). Blackie Academic & Professional.
4. Cowen, A. R., Davies, A. G., &Kengyelics, S. M. (2007). Advances in computed radiography systems and their physical imaging characteristics. *Clinical radiology*, *62*(12), 1132-1141..

Course Title: Medical Ethics and Legal Aspects (Disciplinary Elective-I

Course Code: BRI203

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Outcomes: On completion of this course, the students will be able to:

1. Interact with the patients and other health care professionals.
2. Discuss Ethical, Moral, and Legal Responsibilities.
3. Prioritize patient safety and quality; restrain policies and role of health professionals.
4. Learn about medical terminology- The course employs a body systems-oriented, word-analysis approach to learning medical terminology
5. Emphasize upon Quality Assurance

Course Contents

UNIT-I **18 Hours**

Medical Ethics: Its Role

Definition and Interaction with the patients and health care professionals, Ethical, Moral, and Legal Responsibilities, Patient safety and quality, restrain policies and role of health professionals.

Medical Terms: ICDS, MDM, RCHS, IPR, OPD, IPD, Mortality, Morbidity, Confidential, Issues, Leprosy, ASHA worker, Sympathy, Empathy.

Principles of Medical ethics:

Autonomy

Beneficence,

Confidentiality

Non-Maleficence

Equity or justice.

Negligence and malpractice..

UNIT-II **11 Hours**

Patient vital signs: Temperature, pulse, respiration and blood pressure.

Development of communication skills with patient.

Handling of an unconscious patient, medical negligence.

UNIT-III **08 Hours**

Ethics of medical practice: essential qualities of the radiographer.

Biomedical Waste Management, medical records and reports

Informed consent.

UNIT-IV **08 Hours**

The goal of the class is to prepare students for the terminology they might encounter in their subsequent coursework, in their clinical rotations and ultimately in their roles as health care professionals.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Quality assurance in Diagnostic Radiology" By: J.M. Mclemore (Year book of Medical publishers)
2. Croft, B. (1983). Quality Control in Diagnostic Imaging: JE Gray, NT Winkler, J. Stears, ED Frank. Baltimore, Maryland, University Park Press, 1983, 249 pp,
3. Tortorici, M. R. (1992). *Concepts in Medical Radiographic Imaging: Circuitry, Exposure & Quality Control*. WB Saunders Company.
4. Hayes, G. E. (1987). Quality assurance: Management and technology.
5. Rehani, M. M. (1996). Diagnostic imaging: quality assurance. *Journal of Medical Physics*, *21*(2), 74.

Course Title: Introduction to Quality and Patient Safety (Disciplinary Elective-I

Course Code: BRI204

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Categorize quality improvement approaches, NABH, NABL, JCI guidelines which purely focus on the quality measures and proper handling of equipment's.
2. Become acquainted with basic life support skills which can save many lives in Emergency cases.
3. Assess proper management of biomedical waste, reducing risk of infection due to waste handling by personnel and preventing cross infection which can occur due to improper handling.
4. Learn about Radioactive waste, metals/chemicals/drug waste, BMW management and methods of disinfection, use of Personal protective equipment (PPE).
5. Execute First aid, choking, rescue breathing methods, ventilation including use of bag valve master (BVMs)

Course Contents

UNIT-I **18 Hours**

Quality Assurance and Management

Introduction, Quality improvement approaches, standards and norms, quality improvement tools, introduction to NABH guidelines.

Basic of Emergency Care and Life Support Skills

Basic life support (BLS) following cardiac arrest, recognition of sudden cardiac arrest and activation of emergency response system, early cardiopulmonary resuscitation (CPR) and rapid defibrillation with an automated external defibrillator (AED)

UNIT-II **08 Hours**

Basic Emergency Care

First aid, choking, rescue breathing methods, ventilation including use of bag valve master (BVMs)

Biomedical Waste Management

Definition, waste minimization, BMW-segregation, collection, transportation, treatment and disposal (Including color coding), Liquid BMW, Radioactive waste, metals/chemicals/drug waste, BMW management and methods of disinfection, use of Personal protective equipment (PPE)

UNIT-III **11 Hours**

Infection Prevention and Control

Sterilization, Disinfection, Effective hand hygiene, use of PPE, Prevention and control of common healthcare associated infections, Guidelines (NABH) and JCI for hospital infection control.

UNIT-IV **08 Hours**

Disaster preparedness and management

Fundamentals of emergency management

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Srinivasan, A. V. (Ed.). (2008). *Managing a modern hospital*. SAGE Publications India.
2. Estridge, B. H., & Reynolds, A. P. (2011).*Basic clinical laboratory techniques*. Cengage Learning.
3. Anderson, D. M., Anderson, L. E., &Glanze, W. D. (2002).*Mosby's medical dictionary* (Vol. 26, No. 43, p. 1866). St. Louis: Mosby.

Macpherson, G. (2002). *Black's medical dictionary*. A&C Black

Course Title: English and Communication Skills (Disciplinary Elective-II)

Course Code: BRI205

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes:On completion of this course, the students would be able to

1. Learn the vocabulary, Synonyms, Antonyms, Prefix and Suffix, Homonyms, Analogies and Portmanteau words.
2. Gain knowledge of Active- Passive, Direct and Indirect speech, Prepositions, Conjunctions and Euphemisms
3. Acquire skills of Letter writing, E mail, and Essay, Articles, and Memos, one word substitutes, note making and Comprehension
4. Formulate Summary writing, Creative writing, newspaper reading
5. Study Communication process, Barriers of communication and how to overcome them, Nuances for communicating with patients and their attendants in hospitals.

Course Contents

UNIT-I **14 Hours**

Facets of Literature

Short Stories Homecoming – R.N. Tagore

The Selfish Giant Oscar Wilde

The Diamond Necklace Guy De Maupassant

The Stick – Justice Surinder Singh

Prose

I Have A Dream – Martin Luther King

On Habits – A. G. Gardiner

My struggle for An Education Booker T Washington

On Seeing People Off – Max Beerbohm

Poems

Ozymandias – P.B. Shelley

Daffodils – William Wordsworth

Stopping by Woods on a Snowy Evening – Robert Frost

Forefathers Edmund Blunden

UNIT-II **12 Hours**

Grammar and Usage

Parts of speech

Nouns

Pronouns

Adjectives

Articles

Verbs

Adverbs

Prepositions

Conjunction

Interjection

Identifying parts of speech

Structures: Verb patterns, Question tags,

Course – Verb agreement (concord)

UNIT-III **11 Hours**

Pair of words (Words commonly confused and misused)

Tenses Correction of incorrect sentences

One word Substitution

Translation

Glossary of Administrative Terms (English and Hindi)

Translation from Hindi into English

UNIT-IV **08 Hours**

Paragraph of 100-150 words from outlines

Comprehension Unseen passages of literacy, scientific, data/graph based for comprehension exercises

Communication

Definition, Introduction and Process of Communication

Objectives of Communication 6.3 Notices

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Bramhall, E. (2014). Effective communication skills in nursing practice. *Nursing Standard (2014+)*, *29*(14), 53.
2. Wilkie, H. (2001). *Writing, Speaking, Listening: The Essentials of Business Communication*. How to books Ltd.
3. Austin, D. (1976). *English for nurses*. NiraliPrakashan.
4. Grammar, N. D. E. Reading and Writing Skills by AL Kohli (Course A and course B).

5. Thomson, A. J., & Martinet, A. V. (1986).*Practical English grammar*. Oxford university press.

Course Title: Environment Studies
Course Code: BRI206

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Explain scope and importance of multidisciplinary nature of environment

2. Classify Natural Resources and associated problems.

3. Gain knowledge about use and over exploitation, case studies of forest resources and water resources.

4. Learn concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers

5. Relate Causes, effects and control measures of air pollution

Course Contents

UNIT-I **12 Hours**

Definition And Scope And Importance Of Multidisciplinary Nature Of Environment. Need for public awareness.

Natural Resources

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

Ecosystems

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

UNIT-II **11 Hours**

Environmental Pollution

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

UNIT-III **14 Hours**

Social Blemishes and the Environment

From Unsustainable to Sustainable development, urban problems related to energy, Water conservation, rain water harvesting, water shed management Resettlement and rehabilitation of people; its pros and concerns. Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation, Consumerism and waste products. Environment Protection Act, Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

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

UNIT-IV **08 Hours**

Understanding the Hospital Environment

Understanding the environment in the following clinical laboratories:

Microbiology, Biochemistry, Histopathology, Hematology

Clinical laboratory hazards to the environment from the following and means to prevent:

Infectious material, Toxic Chemicals, Radioactive Material, Other miscellaneous wastes

Course Assessment

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Jadhav, H., &Bhosale, V. M. (1995). Environmental Protection and Laws, Himalaya Pub. *House, Delhi*.
2. O'riordan, T. (2014). *Environmental science for environmental management*. Routledge.
3. Mckinney, M. L., &Schoc J, R. M. (1996). Environmental Science systems & Solutions, Web enhanced edition. 639p. 13. *Mhaskar AK, Matter Hazardous, Techno-Science Publications (TB)*.
4. Miller, G. T., &Spoolman, S. (2015). *Environmental science*. Cengage Learning.

Course Title: Survey paper
Course Code: BRI207

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to,

1. Understand the philosophy of science and ethics, research integrity and publication ethics. To identify research misconduct and predatory publications.

2. Equip themselves with ethical issues related to Research and Publication.

3. Build a strong foundation for future research work in a systematic manner by applying notions of Research Methodology.

4. Assess knowledge of Computer Science to research in real-world issues.

5. Evaluate current research trends in various core areas.

Course Contents

UNIT I **12 Hours**

PHILOSOPHY AND ETHICS Introduction to philosophy: definition, nature and scope, concept, branches - Ethics: definition, moral philosophy, nature of moral judgements and reactions.

SCIENTIFIC CONDUCT: Ethics with respect to science and research - Intellectual honesty and research integrity - Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP) - Redundant Publications: duplicate and overlapping publications, salami slicing - Selective reporting and misrepresentation of data.

UNIT-II **12 Hours**

PUBLICATION ETHICS Publication ethics: definition, introduction and importance - Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. - Conflicts of interest - Publication misconduct: definition,

concept, problems that lead to unethical behaviour and vice versa, types - Violation of publication ethics, authorship and contributor ship - Identification of publication misconduct, complaints and appeals - Predatory publisher and journals.

Unit III **14 Hours**

OPEN ACCESS PUBLISHING Open access publications and initiatives - SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies - Software tool to identify predatory publications developed by SPPU - Journal finger / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester, etc.

PUBLICATION MISCONDUCT Group Discussion: a) Subject specific ethical issues, FFP, authorship b) Conflicts of interest c) Complaints and appeals: examples and fraud from India and abroad Software tools (2 Hrs.) : Use of plagiarism software like Turnitin, Urkund and other open source software tools.

UNIT-IV **07 Hours**

DATABASES AND RESEARCH METRICS Databases : Indexing databases, Citation databases: Web of Science, Scopus, etc. Research Metrics : Impact Factor of journal as per Journal Citations Report, SNIP, SJR, IPP, Cite Score - Metrics: h-index, g index, i10 Index, altmetrics.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Steneck, N. H. (2007). Introduction to the responsible conduct of research. *Washington, DC: US Government Printing Office*. Available at: https://ori.hhs.gov/sites/default/files/rcrintro.pdf

2.Oliver, P. (2010). *The student's guide to research ethics*. McGraw-Hill Education (UK).

3.Shamoo, A. E., &Resnik, D. B. (2009). *Responsible conduct of research*. Oxford University Press.

4.Muralidhar, K., Ghosh, A., &Singhvi, A. K. (2021). *Ethics in science education, research and governance*. Indian National Science Academy.

5.Anderson, B. H. (1997). *Dursaton, and Poole M* (Doctoral dissertation, Thesis and assignment writing, Wiley Eastern).

6.Gustavii, B. (2012). *How to prepare a scientific doctoral dissertation based on research articles*. Cambridge University Press.

Course Title: : Conventional Radiography and Equipment's (Practical)
Course Code: BRI208

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Describe X-Ray tube and its accessories.
2. Use Portable X-Ray Equipment in Wards.
3. Discuss Image intensifier and dental X Ray unit.
4. Implement Radiation protection practices
5. Handle X-ray equipment and accessories

Course Contents

1. X-Ray tubes and accessories, general features.
2. Portable X-Ray Equipment.
3. Image intensifier, its features, spot film.

4. Radiation protection devices
5. Effects of kV and mAs.
6. Maintenance of X-ray equipment and accessories.
7. Mammography X-Ray tube
8. Dental X-Ray unit.

Suggested Readings

1. Stanton, L. (1969). BASIC MEDICAL RADIATION PHYSICS.

2. Seeram, E. (2019). *Digital Radiography: Physical Principles and Quality Control*. Springer.

3. Debnath, J. (2016). Textbook of radiology for residents and technicians. *Astrocyte*, *2*(4), 221-221.

4. Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990). *Christensen's physics of diagnostic radiology*. Lippincott Williams & Wilkins.

5.Allisy-Roberts, P. J., & Williams, J. (2007). *Farr's physics for medical imaging*. Elsevier Health Sciences

Course Title: : Image Acquisition Processing and Archiving (Practical)
Course Code: BRI209

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Discuss Composition of single and double coated Radiographic films.

2. Compare & contrast Effect of grain size on film response to exposure.

3. Explain the film storage rules and guidelines, film handling and care (size, construction and function)

4. Study Radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur Radiographic illuminators and viewing conditions.

5. Plan layout of dark room, location of dark room, entrance, pass box, hatch, hangers, safe light, criteria of safe light, safe light test.

Course Contents

Process of film developing (composition of developer, Fixer and other processing solution)
Common errors and faults while processing (densitometer)
Automatic processing unit (processing cycle)
Developer & Fixer replenishment
Silver recovery.
Film handling and care
Loading and unloading of cassettes
Purpose and location of dark room
Layout of dark room
Entrance
Pass box
Hatch
Hangers
Safe light
Criteria of safe light
Safe light test.

Suggested Readings

1. Bushong, S. C., &Facmp, S. F. (2020). *Radiologic Science for Technologists E-Book: Physics, Biology, and Protection*. Mosby.
2. Chesney, D. N., & Chesney, M. O. (1981). Radiographic imaging
3. Gregory, P. (Ed.). (1996). *Chemistry and technology of printing and imaging systems* (p. 260). Blackie Academic & Professional.

4. Cowen, A. R., Davies, A. G., &Kengyelics, S. M. (2007). Advances in computed radiography systems and their physical imaging characteristics. *Clinical radiology*, *62*(12), 1132-1141..

Course Title: : Clinical radiography positioning I

Course Code: BRI301

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Apply the basic patient positioning during Radiographic investigation
2. Become acquainted with special positioning skills for different pathological and physical conditions
3. Choose proper position during radiography.
4. Learn Supplementary techniques such as in Congenital dislocation of hips, Epiphysis of femur, Lateral projections for hip joints to show femoral head and neck relationship
5. Explain the Radiographic appearances of both normal and common abnormal conditions.

Course Contents

UNIT-I **16 Hours**

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, supra condylar projections. Lower limb: Technique for foot, toes, great toe, tarsal bones, Calcanium, ankle joint, lower leg, knee, patella & femur. Supplementary techniques: Stress view for torn ligaments, a. Subtalar joint and talocalcaneal joint. b. Inter condylar projection of the knee. c. Tibial tubercle. d. Length measurement technique.

UNIT-II **14 Hours**

Shoulder Girdle and Thorax: Technique for shoulder joint, scapular, clavicle, acromioclavicular joints, sternum, ribs, Sterno-clavicular joint. Supplementary projections and techniques a. recurrent dislocation of shoulder. b. Traumatic dislocation of shoulder. c. Cervical ribs.

Vertebral Column: Technique for atlanto-occipital joint, cervical spine, cervico thoracic spine, thoracic spine, thoraco- lumbar spine, limbo sacral spine, sacrum and coccyx. Supplementary techniques to demonstrate: a. Scoliosis. b. Kyphosis c. Spondylolisthesis d. Disc lesion e. Union of spinal graft. Adaptation of techniques to demonstrate specific pathologies. Pelvic girdle and hip region: Technique for whole pelvis. Ilium, ischium, pubic bones, sacro iliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter.

UNIT-III **16 Hours**

Supplementary Techniques- a. congenital dislocation of hips b. Epiphysis of femur: c. Lateral projections for hip joints to show femoral head and neck relationship. Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders. 8. Skull: Basic projections for cranium, facial bones, nasal bones and mandible. Technique for a. Petrous temporal for mastoids. Internal auditory canal. - Accessory nasal sinuses. b. Tempero - mandibular joint. - Orbits and optic foramen. - Zygomatic arches. c. Styloid process. - Pituitary fossa. - Jugular foramen.

UNIT-IV **14 Hours**

Dental Radiography: Technique for intra oral full mouth, occlusal projections, extra oral projections including orthographically, Supplementary techniques. Upper respiratory system: Technique for post nasal airways, larynx, trachea, thoracic inlet - Valsalvamanoeuvre. - Phonation. Lungs and Mediastinum:

Technique For Routine Projections: Projections: Antero-posterior, oblique's,

lordotic, apical projection, use of penetrated poster anterior projection. - Expiration technique. - Technique for pleural fluid levels and adhesions. Abdominal viscera: For plain film examination, Projection for acute abdomen patients. Technique to demonstrate

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Whitley, A. S., Jefferson, G., Holmes, K., Sloane, C., Anderson, C., &Hoadley, G. (2015). *Clark's Positioning in Radiography 13E*. crc Press.
2. Ballinger, P. W., & Frank, E. D. (1999). *Merrill's atlas of radiographic positions and radiologic procedures. Vol. 3*. Mosby.
3. Holm, T., Palmer, P. E., Lehtinen, E., & World Health Organization. (1986). *Manual of radiographic technique*. World Health Organization.
4. Paul, T. R. (2012). *Radiologic Technology at a Glance* . Cengage Learning.
5. Bryan, G. J. (1970). *Diagnostic radiography: A manual for radiologic technologists*. Williams and Wilkins Company.

Course Title: : Modern Radiological & Imaging Equipment including Physics

Course Code: BRI302

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Identify medical radiation related instrumentation and apply techniques associated with diagnostic imaging and radiation oncology.
2. Describe Mammographic Equipment.
3. Discuss Vascular Imaging Equipment & its historical developments.
4. Gain Knowledge of Basics in Computed, Digital Radiography and Computed Tomography.
5. Discuss Vascular Imaging Equipment & its historical developments.

Course Contents

12 Hours

UNIT-I

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

18 Hours

UNIT-II

Special Equipment: Portable and mobile x-ray units, dental x-ray machine, skull table Generator, x-ray tubes; Accessories; Resolution; Quality control; Application and role in medicine. , digital radiographic equipment, digital subtraction techniques. Tomography: Body section radiography, basic principle

and equipment, multi section tomography, various types of tomographic movements, Dual energy x-ray absorptiometry (DEXA), stats can.

16 Hours

UNIT-III

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.

14 Hours

UNIT-IV

Vascular Imaging Equipment: Introduction, historical developments

Principle, scanned projection radiography

Digital subtraction angiography, applications and definition of terms

.Picture archiving and communication system (PACS)

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Stanton, L. (1969). BASIC MEDICAL RADIATION PHYSICS.
2. Fundamental of X-ray and Radium Physics - Joseph Selman
3. Debnath, J. (2016). Textbook of radiology for residents and technicians. *Astrocyte*, *2*(4), 221-221.
4. Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990). *Christensen's physics of diagnostic radiology*. Lippincott Williams & Wilkins.
5. Allisy-Roberts, P. J., & Williams, J. (2007). *Farr's physics for medical imaging*. Elsevier Health Sciences.

Course Title: : Contrast & Special Radiography Procedures

L	T	P	Cr.

Course Code: BRI303

4	**0**	**0**	**4**

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Grasp the responsibility of radiographer during radiological procedures.
2. Approve the basic techniques and their correlation with other techniques of the subsequent special procedures.
3. Classify the various types of contrast media used in radiology.
4. Determine appropriate patient interaction and preparation for all Radiographic examinations and procedures maintaining the principle of sterile technique and execute the knowledge of c-arm and manipulation.
5. Discuss all the radiological examination namely MCU, RGU, IVP, and Barium studies.

Course Contents

18 Hours

UNIT-I

Special Radiographic Procedures:- Responsibility of Radiographer during Radiological Procedures.Preparation of Patient for Different Procedures. Contrast Media - Positive and Negative, Ionic & Non – Ionic Adverse Reactions To Contrast Media and Patient Management Emergency Drugs in the Radiology Department Emergency Equipment's In the Radiology Department Aseptic technique Indications, contraindications, basic techniques and relationship to other techniques of the following special procedures

16 Hours

UNIT-II

Gastrointestinal Tract: Fluoroscopy, general considerations, responsibility of radiographers Barium swallow, pharynx and esophagus Barium meal and

follow through Hypotonic duodenography Small bowel enema Barium Enema routine projections for colon and rectum, colonic activators; double contrast studies; colostomy. Special techniques for specific disease to be examined Water soluble contrast media - e.g. gastrograffin studies b. Salivary glands: Routine technique, procedure – Sialography

14 Hours

UNIT-III

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

Urinary system: Intravenous urography retrograde pyelography Ante grade pyelography Cystography and micturatingcystourethrography (ascending) renal puncture, RGP,

12 Hours

UNIT-IV

Female Reproductive System: Hysterosalpingography.

Respiratory system: Bronchography, Sinography: Routine technique and procedure. Fistulogram.

Lacrimal system: Dacrocystography (DCG)

Lymphatic system: Lymphangiography

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Berlin, L. (1994). A Guide to Radiological Procedures. *Radiology*, *191*(2), 506-506.

– Chapman, S., &Nikielny, R. (1986). A guide to radiological procedures.

2. Gupta, A. K., Garg, A., &Khandelwal, N. (2017).*Diagnostic Radiology: Gastrointestinal and Hepatobiliary Imaging*. JP Medical Ltd.

Course Title: : Basic Physics including Radiological Physics (Disciplinary Elective-III)

Course Code: BRI304

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Determine the nature and propagation of sound waves.
2. Explain Interference of sound waves, beats, diffraction, and Doppler's effect.
3. Differentiate between conduction, convection and radiation.
4. Analyze the applications of the Ampere's law, electromagnet and solenoids
5. Evaluate Concepts of Electromagnetic induction, efficiency of transformer, source of power loss.

Course Contents

UNIT-I 14 Hours

Electricity and Magnetism: A.C. and D.C. power supply with examples, single phase and poly phase power supply, switches, fuses, circuit breakers, earthing etc. main voltage drop: causes and remedy, cables; low tension, high tension. DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current, Ammeter, voltmeter, Galvanometer. Magnets and magnetic field, force on an electric current in a magnetic field, force on electric charge moving in a magnetic field, magnetic field due to straight wire ; force between two parallel wires, Ampere's law, electromagnet and solen oids .

UNIT-II **12 Hours**

Rectification and Transformers: Thermionic emission; - variation of anode current with anode voltage and filament temperature; principle of rectification, wave form of half wave and full wave current/voltage wave form; Rectifiers: Introduction, energy bands in solids, the semiconductor, p-type and n-type semiconductors, density of charge carriers and conductivity, p-n junction, p-n junction diode, p-n junction diode as rectifier (half- wave and full-wave rectifier), rectifiers relative merits and demerits; silicon, germanium diodes. Principles of transformer, Electromagnetic induction, transformer design, efficiency of transformer, source of power loss

UNIT-III **11 Hours**

Electromagnetic Radiation: Electromagnetic radiation spectrum, common properties of electromagnetic radiation; relationship between energy, frequency, wavelength and velocity e.g. X-rays and gamma rays. Properties of X-rays and gamma rays; General properties of X-rays, velocity, frequency etc., photographic effect, photochemical effect – discoloration of salts, heating effect, biological effect; ionization of gases e.g. air.. Interaction of radiation with matter: Transmission through matter, law of exponential attenuation, half value layer, attenuation coefficients; interaction of radiation with matter, classical scattering, Compton scatter, photo electric absorption, pair production; practical aspects of radiation absorption and transmission through body tissues. Measurement of X-rays: Unit of quantity of radiation exposure - definition and application of 'roentgen', unit of quantity of radiation dose - definition and application of 'rad', 'gray' and 'rem';

UNIT-IV **08 Hours**

Principle And Application of ionizations chamber and ionization reader unit, film and densitometer, thermo luminescent dosimeter (TLD). X. Quality and quantity of X-rays: Specification and explanation of electron volt (eV), kilovolt (kV) and half value layer (H.V.L) as an index of penetration of the radiation. 9.

Basic radiation protection: Historical development, dose equivalent limit, international recommendations and current code of practice for the protection of radiation workers and the public against ionizing radiation arising from medical and dental use; protective materials, lead - impregnated substances; building materials, lead equivalents of protective, personal monitoring; film badge, pocket dosimeter TLD badges and their uses and relative merits.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Stanton, L. (1969). BASIC MEDICAL RADIATION PHYSICS.

2. Fundamental of X-ray and Radium Physics - Joseph Selman

3. Debnath, J. (2016). Textbook of radiology for residents and technicians.*Astrocyte*, *2*(4), 221-221.

4. Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990). *Christensen's physics of diagnostic radiology*. Lippincott Williams & Wilkins.

5. Allisy-Roberts, P. J., & Williams, J. (2007). *Farr's physics for medical imaging*. Elsevier Health Sciences.

Course Title: Basic Principles of Hospital Management (Disciplinary Elective-III)
Course Code: BRI305

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Impart knowledge about the principles of Hospital Management & Organization.
2. Understand the importance and different functions of Management.
3. Analyze the concepts of inventory control and get awareness regarding the National Programmes of Health and disease eradication/control.
4. Describe key concepts, theories and techniques for analyzing different organizational situations.
5. Demonstrate the dynamic nature of the environment in which planning, organizing, controlling, staffing, decisions making skills are demonstrated and help the organization in implementation of its vision and mission.

Course Contents

UNIT-I **12 Hours**

BASIC PRINCIPLES OF HOSPITAL MANAGEMENT (Common to all specialties – Anesthesia Technology, Cardiac Technology, Clinical Laboratory Technology, Renal Dialysis Technology, Radiology & Imaging Technology, Perfusion Technology, Cath Lab Technology & Blood Banking Technology) Introduction to management & Organization: The evolution of Management, Definition and importance of Management. Planning – Organizing – staffing – Motivating – Leading – Controlling. Management of health care units (in brief). Individual behavior in organization; organizational functioning (Group/Individual); Perception; Motivation MBO; Organizational Development.

UNIT II **08 HOURS**

Planning and Management of Hospitals & Clinical Services: Building and physical layout – space required for separate function – Planning of infrastructure facilities, clinical services, equipment & Human resources – Types of Hospitals. Organization and administration of various clinical services; outpatient services. In-patient services, emergency services, operation theatres, ICU's and super specialty services.

UNIT III **11 Hours**

Organizing of support clinical services & Hospital management: Imaging – CSSD – Laboratory – Blood Bank – diet – Medical Records – Mortuary. Housekeeping – Maintenance (Water, Electricity, Civil, Air Conditioning, Lift) – Pest Control – transport – Security. Forecasting – Purchasing & procurement (Sourcing, methods and procedures) – Storing & issuing, Concept of inventory control, Maintenance of equipments and contracts (with special reference to major biomedical equipments). Trends in financing of Health and Hospital Services – Classification of Hospitals depending on source of financing – roles of financial institutions.

UNIT IV **14 HOURS**

Personnel and quality Management in Hospital & Marketing: Concepts – Manpower planning – Training & Developments – Team Building – Conflict Management – Performance appraisal – Office rules and regulations Outline of Strategic Planning and Marketing. Concepts of quality – Professional Audit System – QA program – Medical Audit – Quality Circle – TQM – Patient Satisfaction – ISO 9000. A brief outline – computerization in hospital departments. Concept, Techniques, Indicators, Evaluation of Efficiency & Effectiveness evaluation of hospital and medical care services. Ethical, current issues and Legal Aspects of Hospitals management services: Laws related to Hospital – Medico Legal Cases law of Torts – Autopsy – Dying declaration – CPA. – Waste Management – Telemedicine – Organ Transplantation – Rehabilitation Service – Health Insurance. Operations Research and

Quantitative Methods in Hospital Administration & Nursing Services in a Hospital

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1 Zahra, S. A. (2003). The practice of management: reflections on Peter F. Drucker's landmark book. *Academy of Management Perspectives*, *17*(3), 16-23.

2. Drucker, P. F. (1974). Tasks, responsibilities, practices. *New Yorks Row*, 121-122..

3. Drucker, P. (2013). *People and performance*. Routledge. .

4. Robbins, S. P., & Coulter, M. (2003). Management, International Edition.

5. Griffin, R. W., Phillips, J. M., & Gully, S. M. (2016). *Organizational behavior: Managing people and organizations*. Cengage Learning.

Course Title: Remedial Biology (Disciplinary Elective-IV)

Course Code: BRI306

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Learn and understand the components of living world, structure and functional system of plant and animal kingdom.

2. Classify salient features of five kingdoms of life.

3. Understand the basic components of anatomy & physiology of plant.

4. Assess the basic components of anatomy & physiology of animals with special reference to human beings.

5. Evaluate and learn about various tissue systems and organ systems in plants and animals.

CourseContents

UNIT-I **14 Hours**

Living world: Definition and characters of living organisms, Diversity in the living world, Binomial nomenclature **Morphology of Flowering plants**: Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed, General Anatomy of Root, stem, leaf of monocotyledons &Dicotylidon, Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae,Virus.

UNIT-II **09 Hours**

Body fluids and circulation: Composition of blood, blood groups, coagulation of blood Composition and functions of lymph, Human circulatory system, Structure of human heart and blood vessels, Cardiac cycle, cardiac output and ECG, **Digestion and Absorption:** Human alimentary canal and digestive glands, Morphology of Flowering plants, Role of digestive enzymes, Digestion, absorption and assimilation of digested food, **Breathing and respiration:** Human respiratory system, Mechanism of breathing and its regulation, Exchange of gases, transport of gases and regulation of respiration, Respiratory volumes

UNIT-III **10 Hours**

Excretory products and their elimination: Modes of excretion, Human excretory system- structure and function, Urine formation, Rennin angiotensin system, Neural control and coordination, Definition and classification of nervous system, Structure of a neuron, Generationand conduction of nerve impulse, Structure of brain and spinal cord, Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata, **Chemical coordination and regulation:** Endocrine glands and their secretions, Functions of hormones secreted by endocrine glands, **Human reproduction:** Parts of female reproductive system, Parts of male reproductive system, Spermatogenesis and Oogenesis, Menstrual cycle

UNIT-IV **12 Hours**

Plants and mineral nutrition: Essential mineral, macro and micronutrients, Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation, **Photosynthesis:** Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis. **Plant respiration:** Respiration, glycolysis, fermentation (anaerobic), **Plant growth and development:** Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators, **Cell** - The unit of life: Structure and functions of cell and cell organelles. Cell division, **Tissues:** Definition, types of tissues, location and functions.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Surana, S. J., Gokhale, S. B., Jadhav, R. B., Sawant, R. L., &Wadekar, J. B. (2008). Antihyperglycemic activity of various fractions of Cassia auriculata Linn. inalloxan diabetic rats. *Indian journal of pharmaceutical sciences*, *70*(2), 227.

2. D-PB, C. P. SRI SHIVARATHREESHWARA NAGAR MYSORE–570 015. *Pathophysiology*, *3*, 1..

3. Mallavadhani, U. V., Vanga, N. R., Jeengar, M. K., & Naidu, V. G. M. (2014). Synthesis of novel ring-A fused hybrids of oleanolic acid with capabilities to arrest cell cycle and induce apoptosis in breast cancer cells. *European journal of medicinal chemistry*, *74*, 398-404.

4. Agrawal, M., Saraf, S., Saraf, S., Dubey, S. K., Puri, A., Gupta, U., ...& Alexander, A. (2020). Stimuli-responsive In situ gelling system for nose-to-brain drug delivery. *Journal of Controlled Release*, *327*, 235-265.

Course Title: Remedial Mathematics (Disciplinary Elective-IV)
Course Code: BRI307

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

CourseContents

1. Learn about sustainable development, urban problems related to energy, Water conservation, rain water harvesting,.
2. Learn about Issues involved in enforcement of environmental legislation Public awareness.
3. Know the theory and their application in Pharmacy
4. Solve the different types of problems by applying theory
5. Appreciate the important application of mathematics in Pharmacy

UNIT-I **14 Hours**

Partial fraction: Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction , Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmaco kinetics, **Logarithms:** Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems., **Function:** Real Valued function

UNIT-II **09 Hours**

Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations

using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmaco kinetic equations.

UNIT-III **10 Hours**

Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula),Derivative of the quotient of two functions (Quotient formula) –**Without Proof**, Derivative of $x^n w.r.t x$, where n is any rational number, Derivative of e^x,, Derivative of $\log_e x$, Derivative of a^x, Derivative of trigonometric functions from first principles**(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application

UNIT-IV **12 Hours**

Differential Equations : Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmaco kinetic equations, Laplace Transform** : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Differential Calculus by Shanthinarayan

2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.

3. Integral Calculus by Shanthinarayan

4. Higher Engineering Mathematics by Dr.B.S.Grewal

Course Title: Clinical Radiography Positioning-I (Practical

Course Code: BRI308

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Determine appropriate patient interaction and preparation for all Radiographic examinations and procedures
2. Critique Radiographs for applicable anatomy, proper position and correct exposure index
3. Formulate appropriate technical factors for Radiographic procedures.
4. Explain the required breathing instructions, patient position, usable surface landmarks and suitable radiation protection during Radiographic procedures
6. Describe central ray direction, Image Receptor (IR) placements, marker location, source-to-image receptor distance (SID).

Course Contents

Regional Radiography:

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

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

All views and techniques Abdomen: Gastrointestinal tract, urinary tract Skeletal Survey.

Suggested Readings

1. Whitley, A. S., Jefferson, G., Holmes, K., Sloane, C., Anderson, C., &Hoadley, G. (2015).*Clark's Positioning in Radiography 13E*. crc Press.

2. Long, B. W., Rollins, J. H., & Smith, B. J. (2018).*Merrill's Atlas of Radiographic Positioning and Procedures E-Book: Volume 3*. Elsevier Health Sciences.

3. Sutherland, R., & Thomson, C. (2007).*Pocketbook of Radiographic Positioning E-Book*. Elsevier Health Sciences.

Course Title: Modern Radiological &Imaging Equipment including Physics (Practical

Course Code: BRI309

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Analyze the production of x-rays and various characteristics
2. Understand contrast image acquisition techniques.
3. Compare various digital radiography image receptor and detector systems.
4. Discuss beam restriction and its effect on patient dose and image quality
5. Define the CT imaging system components and their functions

Course Contents

X-Ray tubes and accessories, general features.

Portable X-Ray Equipment.

Image intensifier, its features, spot film.

Analyze the production of x-rays and various characteristics. Analyze the production of x-rays and various characteristics on protection devices

Effects of kV and mAS.

Maintenance of X-ray equipment and accessories.

Mammography X-Ray tube

Dental X-Ray unit.

Suggested Readings

1. Stanton, L. (1969). BASIC MEDICAL RADIATION PHYSICS.

2. Seeram, E. (2019). *Digital Radiography: Physical Principles and Quality Control*. Springer.

3. Debnath, J. (2016). Textbook of radiology for residents and technicians. *Astrocyte*, *2*(4), 221-221.

4. Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990). *Christensen's physics of diagnostic radiology*. Lippincott Williams & Wilkins.

5. Allisy-Roberts, P. J., & Williams, J. (2007). *Farr's physics for medical imaging*. Elsevier Health Sciences.

Course Title: Contrast & Special Radiography Procedures (Practical

Course Code: BRI310

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Perform mobile and surgical procedures maintaining the principles of sterile technique when applicable
2. Set up fluoroscopic rooms according to individual procedures.
3. Acquire knowledge of Contrast Media administration and management of contrast allergies
4. Perform Radiographic Procedures involving Digestive, Urinary and Reproductive system.
5. Determine appropriate patient interaction and preparation for all Radiographic examinations and procedures

Course Contents

Radiography in various positions for all the special radiological procedures, using contrast media

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

Suggested Readings

1. Debnath, J. (2016). Textbook of radiology for residents and technicians. *Astrocyte*, *2*(4), 221-221.

2. Bhargava, S. K. (2001). *Text Book of Radiology for Residents and Technicians*.CBS Publishers & Distributors.

Course Title: Research Methodology, Biostatistics And IPR

Course Code: BRI311

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Research methods, identifying research problem, Ethical issues in research,
Research design.

2 Overviewtypes of Data, Research tools and Data collection methods, Sampling methods.

3 Understanding of data representation in biostatistics, How to get relevant data, Relation between data & variables.

4 Summarizing data on the pretext of underlined study, Understanding of statistical analysis

5 Understand How & where to get relevant data, Relation between data & variables

Course Contents

12 Hours

UNIT-I

Research Methodology: Introduction to research methods, identifying research problem, Ethical issues in research, Research design.

14 Hours

UNIT-II

Basic Concepts of Biostatistics Types of Data, Research tools and Data collection methods, sampling methods, develops a research proposal. Biostatistics: Need of biostatistics, what is biostatistics: beyond definition, Understanding of data biostatistics, how& where to get relevant data, Relation between data & variables

12 Hours

UNIT-III

Type of variables: defining data set Collection of relevant data: sampling methods Construction of study: population, sample, normality and its beyond (not design of study, perhaps) Summarizing data on the pretext of underlined study, Understanding of statistical analysis (not methods)

07 Hours

UNIT-IV

IPR: Patent, Trade, Copy Right, Entrepreneurship

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Armitage, P., Berry, G., & Matthews, J. N. S. (2008). *Statistical methods in medical research*. John Wiley & Sons.

2. Mahajan, B. K. (1997). Methods in Biostatistics for medical students and research workers.

3. Pagano, M., &Gauvreau, K. (2000). *Principles of biostatistics*. Australia: Duxbury.

Course Title: Clinical Radiography Positioning -II

Course Code: BRI401

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Demonstrate obtaining the correct patient history, patient care, required breathing instructions, patient position, usable surface landmarks and anatomy demonstrated in each procedure.
2. Implement the use of appropriate radiation protection procedures including: collimation, time, distance and shielding
3. Explain the required breathing instructions, patient position, usable surface landmarks and suitable radiation protection during Radiographic procedures
4. Critique skull images for positioning, anatomy, centering, baselines and technical factors
5. Gain knowledge of high KVp technique, Micro and Macro Radiography

Course Contents

UNIT-I **12 Hours**

Radiography Techniqueconsisting of the complete. Radiography of Skull and Radiography of cranial bones; including special techniques for Sellaturcica, orbits, optic foramina, superior orbital fissure and inferior orbital fissure etc. Facial bones; Paranasal sinuses, Temporal bone and Mastoids. Dental Radiography: Radiography of teeth-intra oral, extra oral and occlusal view.

UNIT-II **14 Hours**

Abdomen: Preparation of patients. General abdominal radiography and positioning for fluid and air levels. Plain film examination. Radiography of female abdomen to look for pregnancy. Radiography in case of acute abdomen. Macro radiography: Principle, advantage, technique and applications. Stereography - Procedure - presentation, for viewing, stereoscopes, stereometry.

UNIT-III **18 Hours**

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

UNIT-IV **16 Hours**

Operation Theatre Techniques: General precautions, Asepsis in techniques - Checking of mains supply and functions of equipment, selection of exposure factors, explosion risk, radiation protection and rapid processing techniques. Trauma radiography/Emergency radiography. Neonatal and Pediatric Radiography, Tomography and Tomosynthesis Dual energy X-ray absorptiometry. Forensic Radiography

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1.Whitley, A. S., Jefferson, G., Holmes, K., Sloane, C., Anderson, C., &Hoadley, G. (2015).*Clark's Positioning in Radiography 13E*. crc Press.

2. Bhagava, S. K. (2001). *Text Book of Radiology for Residents and Technicians*.CBS Publishers & Distributors**.**

3. Singh, H. (2016). *Textbook of Radiology Physics*. JP Medical Ltd.

4. Bushberg, J. T., & Boone, J. M. (2011).*The essential physics of medical imaging*.Lippincott Williams & Wilkins.

Course Title: Physics of Newer Imaging Modalities

Course Code: BRI402

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Describe the various generations of Computed Tomography Scanners.
2. Define the CT imaging system, its components and their functions.
3. Discuss image quality as it relates to spatial resolution, contrast resolution, noise, linearity, and uniformity
4. Gain knowledge of MRI, Mammography and Bone Density procedures.
5. Learn advantages & disadvantages of PET-CT & PET MRI

Course Contents

UNIT-I **14 Hours**

Basic principle of CT scan, history of CT scan, EMI, advantages and disadvantages, Equipment description.

Scanning principle, Image acquisition, Image reconstruction, Image manipulation, Image display and documentation, Scanning parameters. Advantages and disadvantages.

UNIT-II **16 Hours**

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

Echo

UNIT-III **14 Hours**

Applications and Apparatus for Nuclear Medicine, Application, Function and instrumentation. Definition, Applications, Clinical uses, advantages & disadvantages of PET-CT. Definition, Applications, Clinical uses, advantages & disadvantages of PET-MRI.

Hida Scan, Bone Scan, Renal Scan

UNIT-IV **16 Hours**

Benefits vs. risk or PET-CT and PET-MRI.

Characteristics and half-life of Radionuclide's commonly used Radionuclide's. Routine protocols Indication and contraindications of PET

Patient preparation technique in PET Scan.

Radiotherapy: Its types and its applications

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Stanton, L. (1969). BASIC MEDICAL RADIATION PHYSICS.

2. Seeram, E. (2019). *Digital Radiography: Physical Principles and Quality Control*. Springer.

3. Debnath, J. (2016). Textbook of radiology for residents and technicians.*Astrocyte*, *2*(4), 221-221.

4. Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990). *Christensen's physics of diagnostic radiology*.Lippincott Williams & Wilkins.

5. Allisy-Roberts, P. J., & Williams, J. (2007). *Farr's physics for medical imaging*.Elsevier Health Sciences.

Course Title: Newer Modalities Imaging Techniques including Patient Care (Open Elective)
Course Code: BRI403

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Identify the major organs as seen in cross sectional anatomy/ pathology of the head, neck, chest, abdomen and pelvis
2. Acquire Skills of Interventional Radiography & Angiography
3. Manage organizations, records related to patients and departmental statistics.
4. Learn the basics of microbiology, Classification of microorganisms, size, shape and structure of bacteria
5. Perform routine pediatric (ages 6 and under) examinations

Course Contents

UNIT-I **14 Hours**

Interventional Radiography: Basic angiography a. History , technique, patient care b. Percutaneous catheterization, catheterization sites, Asepsis c. Guide wire, catheters, pressure injectors, accessories d All forms of diagnostic procedures including angiography, angioplasty, Biliary examination, renal evaluation and drainage procedure. Central Nervous System: a. Myelography b. Cerebral studies c. Ventriculography

UNIT-II **11 Hours**

Arthrography: Shoulder, Hip, Knee, and Elbow 4. Angiography: a. Carotid Angiography (4 Vessel angiography) b. Thoracic and Arch Aortography c. Selective studies: Renal, SMA, Celiac axis d. vertebral angiography e. femoral

arteriography f. Angiocardiography Venography: a. Peripheral venography b. cerebral venography c. Inferior and superior vena cavography d. Relevant visceral phlebography 6. Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophysiology,

UNIT-III **10 Hours**

Hospital Procedure: Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping. Care of the patient : FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients (for example clean linen and receptacles , nursing care; temperature pulse and respiration; essential care of the patient who has a tracheotomy; essential care of the patient who has a colostomy; bedpans and urinals; simple application of a sterile dressing.

UNIT-IV **10 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; hemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons. 4. 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, Hepatitis B, C, and MRSA etc. 5. 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) 6. 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

Suggested Readings

1. Curry, T. S., Dowdey, J. E., & Murray, R. C. (1990). *Christensen's physics of diagnostic radiology*.Lippincott Williams & Wilkins.

2. Podgoršak, E. B. (2006). *Radiation physics for medical physicists* (Vol. 1). Berlin: Springer.

3.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: Physics of Radiotherapy (Open Elective)

Course Code: BRI404

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

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.
5. Employ independent learning strategies to self-evaluate and update professional knowledge of innovations in medical radiation physics.

Course Contents

UNIT-I **12 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.

Dose distribution and scattering in medium: Properties of phantom materials and various types of phantoms, depth dose distribution, dose build-up, percentage depth dose and its influencing factors. Back scatter factor, tissue air ratio and influencing factors. Relation between TAR and PDD. Scatter-air-ratio. Dose calculation of irregular fields using Clarkson's method.

UNIT-II **08 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). Dose calculations for linear accelerator and Co-60 unit using Sc, Sp factors for SSD and SAD methods, irregular fields, asymmetric fields etc.

UNIT-III **11 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, wedge transmission factor, wedge systems, effect of beam quality, design of wedge filters. Bolus, tissue compensators, shielding blocks.

UNIT-IV **14 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. Field flatness and symmetry, beam collimation, field size dependence, electron source, x-ray contamination.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Symonds, P. P., Deehan, C., Meredith, C., & Mills, J. A. (2012). *Walter and Miller's Textbook of Radiotherapy E-book: Radiation Physics, Therapy and Oncology*. Elsevier Health Sciences.

2.Pawlicki, T., Scanderbeg, D. J., &Starkschall, G. (2016). *Hendee's radiation therapy physics*. John Wiley & Son

Course Title: Quality Control in Radiology and Patient Safety (Elective –V)

Course Code: BRI405

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure.
2. Learn routine testing and evaluation of results of routine testing.
3. Keep records related to patients and departmental statistics.
4. Study the general principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually of machine calibration
5. Describe the quality assurance of film and image recording devices

Course Contents

UNIT- I **08 Hours**

Radiation Safety in Diagnostic Radiology 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 the public.

UNIT-II **12 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. 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 equipment; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme. Care and maintenance of diagnostic equipment.

UNIT-III **11 Hours**

Quality Assurance Programme Tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. Basic concepts of quality assurance, 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-IV **14 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 non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields. 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.. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD in mammography. 4. 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.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Bhagava, S. K. (2001). *Text Book of Radiology for Residents and Technicians*.CBS Publishers & Distributors.
2. Singh, H. (2016). *Textbook of Radiology Physics*. JP Medical Ltd.
3. Seeram, E. (2015). *Computed Tomography-EBook: Physical Principles, Clinical Applications, and Quality Control.*Elsevier Health Sciences.
4. Bushong, S. C., &Facmp, S. F. (2020).*Radiologic Science for Technologists EBook: Physics, Biology, and Protection*. Mosby.

Course Title Disaster management (Elective –V)

Course Code: BRI406

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Describe the concepts and point out the main aspects of emergencies, emergencies and catastrophes
2. Determine the fundamentals of urgent and emergency health care
3. Apply clinical and non-clinical skills in emergency and disaster medicine
4. Understand the importance of medical records in the emergency department and understand the most relevant legal and ethical aspects of health care in Emergencies
5. Implement techniques for teamwork, motivation, leadership and dealing with uncertainty in situations

Course Contents

UNIT-I **14 Hours**

Definitions and Concepts
Comprehensive study of Health Emergencies
Bioethics in Accidents, Emergencies and Disasters
Communication Skills in Emergencies
Patient Safety
Biosafety dangerous materials, Management of waste products
New professional skills in Accidents & Emergency Care

UNIT-II **12 Hours**

Team work Communication & Leadership
Personal & Professional Digital Skills
New Technologies in accident & Emergency Care

CBRN incidents

CBRN risks

Handling of an CBRN incidents

UNIT-III **8 Hours**

Organisation of emergency medical systems

Coordination and Health regulation

Information and Record systems

Types of medical transport

UNIT-IV **11 Hours**

General Concepts Security, Scene, Situation

IMV management & Disasters

Organization

Communication

Deployment & Logistics

Sectorization

Triage

Health care

Evacuation

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. A.K. Srivastava Text book of disaster management

2.Rajendra Kumar Bhandari "Disaster education and management

Course Title Fundamentals of Nursing (Elective –V)

Course Code: BRI407

L	T	P	Cr.
2	0	0	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the students will be able to

1. Understand basic introduction to Nursing

2. Learn the meaning ethical aspects of nursing

3. Knowledge of ICN Code of ethics for nurses in Nursing

4. Analyze the identification ,evaluation and model of nursing care plan

5. Demonstrate responsibility for own behavior and growth as an adult learner and a professional

Course Contents

UNIT-I **08 Hours**

Introduction to Nursing, Nursing Care of the patient, Meeting the needs of a patient, Assessment of patient, Infection control, Therapeutic Nursing Care, Introduction to Clinical Pharmacology, First Aid Need for First Aid, Minor injuries and ailments, Fractures, Life threatening conditions, Community emergencies & community resources

UNIT-II **08 Hours**

An Introduction to Nursing.

Definition of Nursing - a profession: qualities of a nurse , Professional etiquette s for Nurses.

Ethical Aspects of Nursing.

ICN code of Ethics for Nurses.

Nurses role in safeguarding the clients rights

UNIT- III **08 Hours**

Terminology, spiritually in Nursing, factors which effect spiritual health

Goals of spiritual care Nursing process :(assessment, nursing diagnosis, planning, intervention, evaluation)

UNIT-IV **06 Hours**

Nursing process.

Description of nursing process-definitions

Characteristics of nursing process-phases of nursing process-assessment-nursing diagnosis,-outcome

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Bessesen, D. H. (2008). *Update on obesity. J*ClinEndocrinolMetab.93(6), 2027-2034.

2. Butryn, M.L., Phelan, S., &Hill, J. O.(2007). Consistent self-monitoring of weight: a key component of successful weight loss maintenance. *Obesity(Silver Spring).* 15(12), 3091-3096.

3. Chu, S.Y. & Kim, L. J. (2007). *Maternal obesity and risk of stillbirth: a metaanalysis*. Am JObstetGynecol, 197(3), 223-228.

4. DeMaria, E. J. (2007). *Bariatric surgery for morbid obesity*. N Engl J Med,356(21), 2176-2183.

Course Title Clinical Radiography Positioning-I (Practical)

Course Code: BRI408

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Gain knowledge of the basic patient positioning during radiographic investigation.
2. Apply special positioning skills for different pathological and physical conditions
3. Explain the radiographic appearances of both normal and common abnormal conditions.
4. Explain relative positions of x-ray tube and patient relevant exposure factors during radiography.
5. Choose proper position during radiography.

Course Contents

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

Skeletal Survey.

Suggested Readings

1. Whitley, A. S., Jefferson, G., Holmes, K., Sloane, C., Anderson, C., &Hoadley, G. (2015).*Clark's Positioning in Radiography 13E*. crc Press.
2. BhDebnath, J. (2016). Textbook of radiology for residents and technicians.*Astrocyte*, *2*(4), 221-221.
3. Bhargava, S. K. (2001). *Text Book of Radiology for Residents and Technicians*. CBS Publishers & Distributors.

Course Title: Physics of Newer Imaging Modalities (Practical)

Course Code: BRI409

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Explain Protocols for various studies- patient preparation-positioning of the patient in MRI
2. Learn Basics of common clinical Nuclear Medicine procedures/techniques
3. Get acquainted with Techniques of ultra-sonography and Computed Tomography
4. Determine Applications of various procedures in well-equipped Hospitals and Diagnostic Centers and quality control of CT
5. Describe the quality assurance of film and image recording devices

Course Contents

Physics, scanning principle and image formation in CT

Identification of different parts of CT scanner

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

Quality control of CT

Suggested Readings

1. Bhagava, S. K. (2001). Text Book of Radiology for Residents and Technicians .CBS Publishers & Distributors.
2. Singh, H. (2016). Textbook of Radiology Physics. JP Medical Ltd.
3. Seeram, E. (2015). Computed Tomography-EBook: Physical Principles, Clinical Applications, and Quality Control.Elsevier Health Sciences.
4. Bushong, S. C., &Facmp, S. F. (2020).Radiologic Science for Technologists EBook: Physics, Biology, and Protection. Mosby.

Course Title: Cross Sectional Anatomy and Physiology

Course Code: BRI501

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the students will be able to

1. Identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR images.
2. Describe anatomical structural relationships. Recognize normal anatomy.
3. Locate and identify pertinent cerebral, upper thorax, mid-thorax, and abdominal anatomy. On CT and MR images, identify anatomical structures of the body and of the head
4. Distinguish between arterial and venous anatomy of the entire body's vascular system.
6. Classify the various sections of anatomical regions and their associated parts.

Course Contents

UNIT-I **15 Hours**

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

UNIT-II **15 Hours**

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

UNIT-III **15 Hours**

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

UNIT-IV **15 Hours**

Anatomy of the Pelvis- Bony structures and associated muscles, Digestive and Urinary systems. Reproductive Organs CT/MR Images of the Male/Female Pelvis- Normal and pathological. Neuro Anatomy- Scan planes. Brain - Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves Spine- Vertebra and disc, Spinal cord and meninges Neck- Arterial/venous systems, Muscles, Glands and pharynx

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Chaurasia, B. D. (2004). *Human anatomy* (p. 53). CBS Publisher.
2. Netter, F. H. (1990). Atlas of Human Anatomy/Frank H. Netter. *East Hanover, New Jersey*, *592*.
3. Agur, A. M., &Dalley, A. F. (2009). *Grant's atlas of anatomy*. Lippincott Williams &Wilkins.
4. Ashalatha, P. R., &Deepa, G. (2012). *Textbook of Anatomy & Physiology for Nurses*. JP Medical Ltd**.**

Course Title: Radiographic Techniques of Advanced Imaging Technology
Course Code: BRI502

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Gain knowledge and experience of basic MRI sequencing and processing
2. Define basic principle and physics of ultrasonography and nuclear medicine.
3. Explain the history and generations CT/MRI., scan and Demonstrate all technical aspects and protocols.
4. Analyze different types of Artifacts and correction. Demonstrate the QA and QC doing himself and take care of QA & QC papers.
5. Evaluate application of color Doppler and Vascular Imaging

Course Contents

UNIT-I **12 Hours**

Ultrasonography Doppler Studies: Techniques of sonography-selection-Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- patient care and maintenance protocols clinical applications display methods –quality image reproducible extend – biopsy procedures, assurance to patients.

UNIT-II **16 Hours**

CT scan Studies Acquisition/ Protocols /Techniques: CT of head and neck – thorax – abdomen – pelvis – muscular skeletal system – spine – PNS. Anatomy – clinical indications and contraindications – patient preparation – technique – contrast media-types, dose, injection technique; timing,

sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.

UNIT-III **18 Hours**

MRI Scanners: Methods of MRI imaging methods – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation- positioning of the patient -patient care-calibration –

UNIT-IV **14 Hours**

Paramagnetic Agents and dose, additional techniques and recent advances in MRI - image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures- reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Bushberg, J. T., & Boone, J. M. (2011).*The essential physics of medical imaging*. Lippincott Williams & Wilkins.
2. Chavhan, G. B. (2013). *MRI made easy*. JP Medical Ltd.
3. Elmaoğlu, M., &Çelik, A. (2011).*MRI handbook: MR physics, patient positioning, and protocols*. Springer Science & Business Media.
4. Seeram, E. (2015). *Computed Tomography-EBook: Physical Principles, Clinical Applications, and Quality Control*. Elsevier Health Sciences

Course Title: Radiographic Techniques of Advanced Imaging Technology
Course Code: BRI503

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Understand basic principle and hardware of CT and MRI.
2. Demonstrate how to improve image quality in different protocols
3. Assess technical aspects, protocol and planning techniques in MRI
4. Prepare and position the patients for ultrasonography and nuclear medicine examination
5. Systematize post processing for Computed Tomography scan

Course Contents

UNIT-I **14 Hours**

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 Advanced Computed Tomography Helical CT scan: Slip ring 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, patient preparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography – (Aortogram, selective angiogram head, neck and peripheral) image documentation and Filing, maintenance of equipment and accessories.

UNIT-II **08 Hours**

Advanced Technique & Instrumentation of MRI a. Basic Principles: Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image. b. Pulse sequence : Spin echo pulse sequence – turbo spin echo pulse sequence - Gradient echo sequence – Turbo gradient echo pulse sequence - Inversion recovery sequence – STIR sequence – SPIR sequence – FLAIR sequence – Echo planar imaging – Advanced pulse sequences.

UNIT-III **11 Hours**

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

UNIT-IV **12 Hours**

Ultrasonography 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 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. f. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety. g. Doppler Ultrasound-

Patient preparation for Doppler, Doppler artifacts, vascular sonography,

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Bhargava, S. K. (2001). *Text Book of Radiology for Residents and Technicians*.CBS Publishers & Distributors.
2. Singh, H. (2016). *Textbook of Radiology Physics*. JP Medical Ltd.
3. Seeram, E. (2015). *Computed Tomography-EBook: Physical Principles, Clinical Applications, and Quality Control.*Elsevier Health Sciences.
4. Bushong, S. C., &Facmp, S. F. (2020).*Radiologic Science for Technologists EBook: Physics, Biology, and Protection*. Mosby.
5. Curry, T. S., Dowdey, J. E., &Murry, R. C. (1990).*Christensen's physics of diagnostic radiology*.Lippincott Williams & Wilkins.

Course TitleCardiac imaging

Course Code: BRI504

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Give and receive scientific critics on a high level.
2. Manage complex research questions and challenge established knowledge and praxis within cardiac imaging research.
3. Describe, plan and conduct independent research using non-invasive cardiac imaging methods.
4. Analyze and discuss scientific critics on a high level.
5. Communicate technical expertise and experience through presentation of own research.

Course Contents

UNIT-I **08 Hours**

Physiological aspects of cardiac imaging

A. Normal cardiac cycle

B. Electrocardiography

C. Physiological anatomy of cardiac muscle

D. Mechanics of cardiac contraction

E. Physical basis for blood flow, pressure, and resistance

UNIT-II **12 Hours**

Anatomy of the heart and great vessels

A. Normal morphology and structure

B. Segmental anatomy of the heart

C. Normal adult heart measurements

Techniques for imaging the heart and great vessels

A. Radiography

B. Computed tomography

C. Magnetic resonance imaging

D. Cardiac scintigraphy (including PET)

E. Other (working understanding)

UNIT-III **14 Hours**

Congenital heart disease: basic

A. Cyanotic versus acyanotic presentations

B. Most common lesions

C. Post-operative assessment of the following procedures:

D. 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

A. Double outlet right ventricle

B. Single ventricle

C. Cortriatriatum

D. Hypo plastic left heart syndrome

E. Hypo plastic right heart syndrome

F. Congenital absence of the pericardium

G. Indications for and post-operative assessment of

H. Late or adult presentations of congenital heart disease

UNIT-IV **11 Hours**

Cardiomyopathy

A. Hypertrophic

B. Dilated

C. Restrictive (also infiltrative)

D. Therapeutic and interventional options

Radiation

Distinguish between exposure, absorbed dose and effective dose

Understand the measurements for dose – CTDI, CTDI 100, dose length product

Understand the weighting factor for various organs and tissues

Be able to read and understand the dose sheets produced by the CT scanner at the end of the examination (I think this should be mandatory)

Dose minimization techniques in cardiac and vascular CT

Understand the implications in terms of dose of increasing the cranio-caudal field of view by “x” cm (e.g. 5 cm) in retrospectively gated cardiac CT.

Understand the dose savings from retrospectively gated to prospectively triggered CT.

Understand the dose savings from reducing the kvp from 120 to 100

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Skorton, D. J., Marcus, M. L., &Braunwald, E. (Eds.). (1996). *Marcus cardiac imaging: a companion to Braunwald's heart disease* (Vol. 2). Saunders.

2. Boxt, L., &Abbara, S. (2015). *Cardiac Imaging: The Requisites E-Book*. Elsevier Health Sciences.

Course Title; Hospital practice & patient care (Elective-VII)

Course Code: BRI505

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Gain knowledge regarding maintenance of medical record and documents in radiology department

2. Understanding transferring the patients without causing any hurdle and can restrain the un co-operative patients throughout radiological examinations.

3. Categories the moral, clinical and ethical liability of radiographer.

4. Analyze sterilized techniques to reduce the chance of infection in work practices.

5. Evaluate the vital signs, handle equipments used for diverse procedures.

Course Contents

UNIT-I **11 Hours**

Hospital Staffing and Administration, records, professional, ethics, cooperation with other staff and departments, Departmental organizations. Handling of the patients, seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, drug addicts and non-English speaking patients. Understanding patient needs - patient dignity of inpatient and out patients. Interaction with the patient's relatives and visitors.

UNIT-II **08 Hours**

Methods of Effective Communication - Verbal skills, body language, professional appearance, visual contact etc. Elementary personal and departmental hygiene, dealing with receptacles, bedpans and urinals etc. General preliminaries to the exam.

UNIT-III **12 Hours**

Moving Chair and Stretcher Patient. Unconscious patient, general comfort and reassurance for the patient. Vital signs and oxygen - patient's Homeostasis status. Body temp, respiratory rate, pulse, blood pressure, oxygen therapy, oxygen devices, Chest tubes and lines.

UNIT-IV **14 Hours**

First aid - Shock, electrical shock, hemorrhage, burns, Asphyxia, fractures, loss of consciousness. Emergency treatment to the collapsed patient. Artificial respiration and resuscitation. Preparation of patients for general and special radiological examinations. Supervision of patients undergoing special examination. Administration of drugs and contrast media. Aseptic

and Sterile procedures. Handling of infections patients in the department or in the ward. Regulation of dangerous drugs. Trolley set up for special x-ray examinations, Radiation hazardous and protective measures.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Ashalatha, P. R., &Deepa, G. (2012).*Textbook of Anatomy & Physiology for Nurses*. JP Medical Ltd.
2. Pal, G. K. (2006).*Textbook Of Practical Physiology-2Nd Edn*. Orient Blackswan.
3. Ehrlich, R. A., &Coakes, D. M. (2016).*Patient care in radiography-ebook: with an introduction to medical imaging*. Elsevier Health Sciences.
4. Adler, A. M., & Carlton, R. R. (2015).*Introduction to Radiologic and Imaging Sciences and Patient Care-EBook*. Elsevier Health Sciences.

Course Title: Regulatory Requirements in Diagnostic Radiology & its Imaging Act &

Course Code: BRI506

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Enumerate how to work as per the AERB safety guidelines in clinical setup.
2. Manage and Care of patient during emergency situations.
3. Gain knowledge of departmental layouts for protection of patients, occupational workers and general public.

4. Regulate radiation practices according to internationally accepted methods.
5. Plan a Radiology department in a Hospital

Course Contents

UNIT-I **14 Hours**

Regulatory Bodies & Regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regulatory body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements.

UNIT-II **08 Hours**

Role of Radiographer in Planning: QA & Radiation Protection: Role of technologist in radiology department - Personnel and area monitoring, Setting up of a new X-Ray unit, staff requirement,

UNIT-III **11 Hours**

AERB specifications for site planning and mandatory guidelines – Planning of X-ray rooms, dark rooms – Inspection of X-Ray installations - Registration of X-Ray equipment installation- Certification

UNIT-IV **12 Hours**

Evaluation Of Workload Versus Radiation Factors: Occupational exposure and protection Tools/devices. ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection. NABH guidelines, AERB guidelines, PNDT Act and guidelines

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Bhagava, S. K. (2001). *Text Book of Radiology for Residents and Technicians*.CBS Publishers & Distributors.
2. Singh, H. (2016). *Textbook of Radiology Physics*. JP Medical Ltd.

Course Title: Introduction to Health Care System

Course Code: BRI507

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Achieve a basic understanding of the major components of the current & potential health care delivery systems.
2. Anticipate the interaction of health care providers and diverse patients/families with the various components of the health care systems.
3. Describe the theories/models of leadership & management most effective in the current & potential health care systems.
4. Describe the communication styles of the primary health care providers, e.g., administrators, financial officers, managers, doctors, nurses, patients from low, moderate & high socioeconomic status.
5. Evaluate three roles the student plans to develop to be a contributing member of the health care system.

Course Contents

UNIT: I **08 Hours**

Introduction to healthcare delivery system - Healthcare delivery system in India at primary, secondary and tertiary car; Community participation in healthcare delivery system; Health system in developed countries; Private /

Govt Sector; National Health Mission; National Health Policy; Issues in Health Care Delivery System in India

UNIT: II **10 Hours**

National Health Programme- Background objectives, action plan, targets, operations, achievements and constraints in various National Heath Programme. Introduction to AYUSH system of medicine - Introduction to Ayurveda; Yoga and Naturopathy; Unani; Siddha; Homeopathy; Need for integration of various system of medicine

UNIT: III **16 Hours**

Health Scenario of India- past, present and future

Demography & Vital Statistics-

Demography – its concept

Census & its impact on health policy

UNIT-IV **11 Hours**

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

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Buchbinder, S. B., & Thompson, J. M. (2010). *Career opportunities in health care management: Perspectives from the field*. Jones & Bartlett Publishers.

2. Franco, O. H., Peeters, A., Bonneux, L., & De Laet, C. (2005). Blood pressure in adulthood and life expectancy with cardiovascular disease in men and women: life course analysis. *Hypertension*, *46*(2), 280-286.

Course Title: Cross Sectional Anatomy and Physiology (Practical
Course Code: BRI508

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Explain normal disposition of various structures and organs in the body and its clinical correlation
2. Evaluate and maintain an accurate record of the effectiveness of the cleaning, disinfecting and sterilizing processes in medical professions.
3. Describe the microscopic structure of various tissues
4. Identify organs and tissues under microscope
5. Determine the topography of various structures on the surface of the body

Course Contents

Identification and description of all anatomical structures.

Demonstration of dissected parts

Demonstration of skeleton-articulated and disarticulated.

Surface anatomy: Surface landmark-bony, muscular and ligaments. Surface anatomy of major nerves, arteries of the limbs

Suggested Readings

1. Ashalatha, P. R., &Deepa, G. (2012).*Textbook of Anatomy & Physiology for Nurses*. JP Medical Ltd.

2. Pal, G. K. (2006).*Textbook Of Practical Physiology-2Nd Edn.* Orient Blackswan.

3. Chaurasia, B. D. (2004). *Human anatomy* (p. 53). CBS Publisher.

Course Title: Radiographic Techniques of Advanced Imaging Technology (Practical
Course Code: BRI509

L	T	P	Cr.
0	0	6	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the students will be able to

1. Scan with various Computed Tomography protocols for better representation of images
2. Manage patients for any post contrast reactions
3. Learn the measures for improving image quality in ultrasonography and nuclear medicine.
4. Describe circuit system of radiology equipment's.
5. Learn protocols needed for Magnetic Resonance Imaging examination.

Course Contents

Physics, scanning principle and image formation in CT/MRI/USG

Identification of different parts of CT /MRI/USG scanner

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

Quality control of CT /MRI

Suggested Readings

1. Bhargava, S. K. (2001). *Text Book of Radiology for Residents and Technicians*.CBS Publishers & Distributors.

2. Debnath, J. (2016). Textbook of radiology for residents and technicians.*Astrocyte*, *2*(4), 221-221.
3. Chavhan, G. B. (2013). *MRI made easy*. JP Medical Ltd.
4. Maqbool, M. (Ed.). (2017). *An introduction to medical physics*. Springer.

Course Title: Professional Training/ Internship

Course Code: BRI601

L	T	P	Cr.
0	0	0	20

Total Hours 300

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Work as per the AERB safety guideline in clinical setup.
2. Recognize their role in the health care system and function effectively in a multidisciplinary health care team

3. Perform radiographic procedures ensuring safety of patients and personnel involved

4. Demonstrate knowledge of specified imaging modalities, relevant anatomy, image quality assurance and diagnostic decision making.
5. Practice professional and ethical responsibilities with high degree of credibility, integrity and social concern.

Course Contents

Students have to carry out a research project (on any topic related to radiology) under the supervision of a faculty. The project report has to be prepared on the

basis of the research work carried out. The assessment is done on the basis of the work done and the presentation and viva

Total Number of Course	38
Number of Theory Course	22
Number of Practical Course	11
Total Number of Credits	**144**

ACADEMIC INSTURCTIONS

Attendance Requirements

A student shall have to attend 75% of the scheduled periods in each course in a semester; otherwise he / she shall not be allowed to appear in that course in the University examination and shall be detained in the course(s). The University may condone attendance shortage in special circumstances (as specified by the Guru Kashi University authorities). A student detained in the course(s) would be allowed to appear in the subsequent university examination(s) only on having completed the attendance in the program, when the program is offered in a regular semester(s) or otherwise as per the rules.

Assessment of a course

Each course shall be assessed out of 100 marks. The distribution of these 100 marks is given in subsequent sub sections (as applicable).

	Internal (50)						**External (50)**	**Total**
Components	**Attendance**	**Assignment**			**MST 1**	**MST2**	**ETE**	
		A1	A2	A3				
Weightage	10	10	10	10	30	30	50	
Average Weightage	10		10		30		50	100

Passing Criteria

The students have to pass both in internal and external examinations. The minimum passing marks to clear in examination is 40% of the total marks.