Department of Radiology and Imaging Techniques Era University, Lucknow

Course Outline

Effective From 2023-24

Name of the Program	**B.R.I. T**			**Year/ Semester:**	**IV**
Course Name	**Clinical Radiography Positioning -II**	**Course Code:**	**BRT 402**	**Type: Semester**	**Theory**
Credits	**03**			**Total Sessions Hours:**	**60**
Evaluation Spread	**Internal Continuous Assessment:**	**30**		**End Term Exam:**	**70**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography. At the end of the course, the student should be able to:				
Course Outcomes (CO): *After the successful course completion, learners will develop the following attributes:*					
Course Outcome (CO)					
CO1	Explain the role of the radiographer and the positioning of various body parts, the normal functioning of various organ systems of the body, and their interactions.				
CO2	Elucidate the radiological aspects of normal growth and development.				
CO3	Describe the patient's response and adaptations to environmental stresses.				
Pedagogy	Explanations by the Instructor, Group/Pair Work, Discussion, Assignment, Practical, Presentations.				
Internal Evaluation Mode	Terminal Exam, Attendance, Project/Assignment, Class participation, Class presentation, Bedside behavior or Interaction in class.				
Session Details	**Topic**			**Hours**	**Mapped CO**

Unit 1	Radiography technique comprising the complete. Radiography of Skull and Radiography of cranial bones; including special techniques for sella turcica, 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, extraoral, and occlusal view.	22	CO1 ,CO 2
Unit 2	Abdomen: Preparation of patient. 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. Macroradiography: Principle, advantage, technique, and applications. Stereography - Procedure - presentation, for viewing, stereoscopes, stereometry.	22	CO2 ,CO 3

Unit 3	Localization of foreign bodies. Various techniques Ward /mobile radiography - electrical supply, radiation protection, equipment, and instructions to be followed for portable/ward radiography**.**	22	CO2,CO 3
Unit 4	Preparation 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 Paediatric Radiography, Tomography and Tomosynthesis Dual- energy X-ray absorptiometry. Forensic Radiography.	23	CO2,CO 3

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	2	1	3	2	1	2	1	3	1	2
CO2	2	2	1	2	3	2	2	1	2	3	2	2	2	2
CO3	2	3	2	1	2	2	2	2	3	3	2	1	2	3

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books

1. Clark's Radiography- Clark/Textbook of radiology for residents and technicians- s k Bhargava.
2. Radiographic positioning- Garkal
3. Radiology- Special investigation -champman.

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Terminal Examination	12	1. Contains a descriptive question of 4 marks 2. Contains 4 MCQs Contains 2 short answer questions. Each question carries 2 marks
Attendance	4	
Projects/Assignments	4	

Assignment/ Presentation	2	
Attendance	2	
Total Marks	**30**	

Department of Radiology and Imaging Techniques Era University, Lucknow

Course Outline

Effective From 2023-24

Name of the Program	**B.R.I. T**			**Year/ Semester:**	**IV**
Course Name	**Clinical Radiography Positioning -II**	**Course Code:**	**BRP 402**	**Type: Semester**	**Practical**
Credits	**03**			**Total Sessions Hours:**	**60**
Evaluation Spread	**Internal Continuous Assessment:**	**30**		**End Term Exam:**	**70**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography. At the end of the course, the student should be able to:				
Course Outcomes (CO): *After the successful course completion, learners will develop the following attributes:*					
Course Outcome (CO)					
CO1	Explain the role of the radiographer and the positioning of various body parts, the normal functioning of various organ systems of the body, and their interactions.				
CO2	Elucidate the radiological aspects of normal growth and development.				
CO3	Describe the patient's response and adaptations to environmental stresses.				
Pedagogy	Explanations by the Instructor, Group/Pair Work, Discussion, Assignment, Practical, Presentations.				

Internal Evaluation Mode	Terminal Exam, Attendance, Project/Assignment, Class participation, Class presentation, Bedside behavior or Interaction in class.		
Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	Radiography technique comprising the complete. Radiography of Skull and Radiography of cranial bones; including special techniques for sella turcica, 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, extraoral, and occlusal view.	15	CO1 ,CO 2
Unit 2	Abdomen: Preparation of patient. 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. Macroradiography: Principle, advantage, technique, and applications. Stereography - Procedure - presentation, for viewing, stereoscopes, stereometry.	15	CO 2,C O 3

Unit 3	Localization of foreign bodies. Various techniques Ward /mobile radiography - electrical supply, radiation protection, equipment, and instructions to be followed for portable/ward radiography**.**	15	CO2,CO 3
Unit 4	Preparation 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 Paediatric Radiography, Tomography and Tomosynthesis Dual- energy X-ray absorptiometry. Forensic Radiography. **.** All views and techniques Abdomen: Gastrointestinal tract , urinary tract.	15	CO1 ,CO3

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	1	2	2	2	2	1	2	3	2	3	2	3
CO2	2	2	3	2	2	3	2	2	3	2	3	2	2	2
CO3	1	2	2	2	3	2	3	3	2	2	2	3	3	2

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books

4. Clark's Radiography- Clark/Textbook of radiology for residents and technicians- s k Bhargava.
5. Radiographic positioning- Garkal
6. Radiology- Special investigation -champman.

Recapitulation & Examination Pattern

C

Component	**Marks**	**Pattern**
Terminal Examination	12	3. Contains a descriptive question of 4 marks 4. Contains 4 MCQs Contains 2 short answer questions. Each question carries 2 marks
Attendance	4	
Projects/Assignments	4	
Class Participation or any other	4	

Bedside behaviour	02	
Total marks	30	

Department of Radiology and Imaging Techniques Era University, Lucknow

Course Outline

Effective From 2023-24

Name of the Program	**B.R.I.T**			**Year/ Semester:**	**IV**
Course Name	**Newer Modalities Imaging Techniques including patient care**	**Course Code:**	**BRT 403**	**Type: Semester**	**Theory**
Credits	**03**			**Total Sessions Hours:**	**40**
Evaluation Spread	**Internal Continuous Assessment:**	**30**		**End Term Exam:**	**70**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography patient care and code of ethics. At the end of the course, the student should be able to				
Course Outcomes (CO): *After the successful course completion, learners will develop the following attributes:*					
Course Outcome (CO)					
CO1	Understood Introduction to hospital staffing and Medical records and documentation.				
CO2	Must know about Legal issues and Professional ethics.				
CO3	How to handle and must know Departmental Safety and Infection control				
CO4	Understood Body mechanics and transferring of the patient.				
Pedagogy	Explanations by the Instructor, Group/Pair Work, Discussion, Assignment, Practical, Presentations.				
Internal Evaluation Mode	Terminal Exam, Attendance, Project/Assignment, Class participation, Class presentation, Bedside behavior or Interaction in class.				

Session Details	Topic	Hours	Mapped CO
Unit 1	lnterventional Radiography: Basic angiography and DSA: a. History , technique, patient care b. Percutaneous catherisation, catheterization sites, Asepsis c. Guidewire, catheters, pressure injectors, accessories d. Use of digital substraction- single plane and bi-plane All forms of diagnostic procedures including angiography, angioplasty, bilary examination, renal evaluation and drainage procedure. Central Nervous System: a. Myelography b. Cerebral studies c. Ventriculography Arthrography: Shoulder, Hip, Knee, Elbow 4. Angiography: a. Carotid Angiography (4 Vessel angiography) b. Thoracic and Arch Aortography c. Selective studies: Renal, SMA, Coeliac axis d. Vertebral angiography e. Femoral arteriography f. Angiocardiography Venography: a. Peripheral venography b. Cerebral venography c. Inferior and superior venocavography d. Relevant visceral phlebography 6. Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophyiology,	22	CO1 ,CO 2
Unit 2	Microbiology 1. Introduction and morphology - Introduction of microbiology, Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria. 2. Growth and nutrition -nutrition, culture media, types of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test Sterilization and disinfection - principles and use of equipments of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization, anti-septic and disinfectants. Introduction to immunology, bacteriology, parasitology, mycology.	22	C02, CO3

Unit 3	Hospital procedure: Hospital staffing and organization; records relating to patients and members of the staff; medico-legal aspects; accidents in the departments, appointments, and 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 about patients (for example clean linen and receptacles, nursing care; temperature pulse and respiration; essential care of the patient who has a tracheostomy; essential care of the patient who has a colostomy; bedpans and urinals; simple application of a sterile dressing.	22	CO3,CO 4
Unit 4	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; bums; 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 filamented 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 of accidents in the department.	24	CO1,CO 3

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	3	1	2	2	3	3	2	3	3	2	2	3
CO2	3	2	2	2	3	2	2	2	1	3	2	3	2	3
CO3	2	3	2	3	3	3	2	2	2	2	1	1	2	2
CO4	3	2	1	2	2	1	2	3	3	2	3	3	3	1

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books	1. Clark's Radiography- Clark/Textbook of radiology for residents and technicians- s k Bhargava 2. Radiographic positioning- Garkal 3. Radiology- Special investigation - champman.

Recapitulation & Examination Pattern

Internal Continuous Assessment:			
Component	**Marks**	**Pattern**	
Terminal Exam	12	1. Contains a descriptive question of 4 marks 2. Contains 4 MCQs 3. Contains 2 short answer questions. Each question carries 2 marks	2
Attendance	04		
Project/Assignments	04		
Class participation or any other	04		
Class Presentation	04		
Bed Side Behavior or Interaction in Class	02		
Total Marks	30		

Department of Radiology and Imaging Techniques Era University, Lucknow

Course Outline

Effective From 2023-24

Name of the Program	**B.R.I.T**			**Year/ Semester:**	**IV**
Course Name	**Newer Modalities Imaging Techniques including patient care**	**Course Code:**	**BRP 403**	**Type: Semester**	**Practical**
Credits	**03**			**Total Sessions Hours:**	**60**
Evaluation Spread	**Internal Continuous Assessment:**	**25**		**End Term Exam:**	**70**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography patient care and code of ethics. At the end of the course, the student should be able to				
Course Outcomes (CO): *After the successful course completion, learners will develop the following attributes:*					
Course Outcome (CO)					
CO1	Understood Introduction to hospital staffing and Medical records and documentation.				
CO2	Must know about Legal issues and Professional ethics.				
CO3	How to handle and must know Departmental Safety and Infection control				
CO4	Understood Body mechanics and transferring of the patient.				

Pedagogy	Explanations by the Instructor, Group/Pair Work, Discussion, Assignment, Practical, Presentations.		
Internal Evaluation Mode	Terminal Exam, Attendance, Project/Assignment, Class participation, Class presentation, Bedside behavior or Interaction in class.		
Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	.Medical records and documentation. .Legal issues in radiology department, PNDT Act. .Professional ethics and Code of conduct of radiographer.	15	CO2 ,CO 3
Unit 2	.Handling of patients: Seriously ill and traumatized patients, visually impaired, hearing and speech impaired patients, mentally impaired patients, infectious patients. .Departmental Safety	15	CO3 ,CO 4

Unit 3	.Infection control: skin care, donning of gowns, gloves, face masks, head caps, shoe covers. .Vitals signs.	15	CO2,CO 3
Unit 4	Body mechanics and transferring of patient, draw sheet lift, use of slide boards, wheelchair to couch, couch to wheelchair, couch to table, three men lift and four men lift. .Local anaesthesia and general anaesthesia .Facilities regarding general Anaesthesia in the X-ray department .Management of adverse reactions to contrast media	15	CO2,CO 4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	1	2	3	2	2	2	3	1	2	3	2
CO2	3	2	2	3	3	2	1	3	3	2	2	1	2	3
CO3	2	2	3	2	2	3	3	2	2	2	3	3	2	3
CO4	2	2	3	3	2	2	3	2	3	2	3	2	3	2

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books

1. Clark's Radiography- Clark/Textbook of radiology for residents and technicians- s k Bhargava

2. Radiographic positioning- Garkal
3. Radiology- Special investigation - champman.

Recapitulation & Examination Pattern

Internal Continuous Assessment:		
Component	**Marks**	**Pattern**
Terminal Exam	12	4. Contains a descriptive question of 4 marks 5. Contains 4 MCQs 6. Contains 2 short answer questions. Each question carries 2 marks
Attendance	04	
Project/Assignments	04	
Class participation or any other	04	
Class Presentation	04	
Bed Side Behavior or	02	

Interaction in Class		
Total Marks	30	

Department of Radiology and Imaging Techniques

Era University, Lucknow

Course Outline

Effective From 2023-24

Name of the Program	**B.R.I.T**			**Year/ Semester:**	IV
Course Name	**Physics of newer imaging modalities**	**Course Code:**	**BRT 401**	**Type: Semester**	**Theory**
Credits	**03**			**Total Sessions Hours:**	**40**
Evaluation Spread	**Internal Continuous Assessment:**	**30**		**End Term Exam:**	**70**
Type of Course	○ Compulsory	● Core		○ Creative	○ Life Skill
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography using newer modalities of radiology. At the end of the course, the student should be able to know about ultrasonography Computed Tomography, the Generation of CT Scanners, Magnetic resonance imaging, fusion imaging PET, Contrast media use, handling, and teleradiology.				
Course Outcomes (CO): *After the successful course completion, learners will develop the following attributes:*					
Course Outcome (CO)					
CO1	Able to know Computed Tomography its principles, various generations, and advancements				
CO2	Able to know Magnetic Resonance Imaging- its principle, advancements, and applications.				
CO3	Explain and be able to know Ultrasonography, Color Doppler- its principle, advancements, and applications. Digital Radiography and Digital subtraction angiography equipment- principle, advancements, and applications.				
CO4	Able to know Fusion Imaging including PET-CT, PET, and PET-MRI. Digital Mammography, DEXA equipment- principle, advancements, and applications.				

CO 5	Able to know tele radiology HIS, RIS, and PACS, Image processing in digital radiography systems; And processing techniques in console using CR, DR, and flat panel fluoroscopy systems.		
Pedagogy	Explanations by the Instructor, Group/Pair Work, Discussion, Assignment, Practical, Presentations		
Internal Evaluation Mode	Terminal Exam, Attendance, Project/Assignment, Class participation, Class presentation, Bedside behavior or Interaction in class.		
Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	Basic principle of CT scan, history of CT Scan, EMI, advantages and disadvantages, Equipment description.	18	CO2 ,CO 3
Unit 2	Scanning principle, Image acquisition, Image reconstruction, Image manipulation, Image display and documentation, Scanning parameters. Advantages and disadvantages.	18	CO1 ,CO 4

Unit 3	History of MRI, Magnetism, Basic Principle, 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	18	CO4,CO 5
Unit 4	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	18	CO3,CO 4
Unit 5	Benefits vs risk or PET-CT and PET-MRI. Characteristics and half-life of Radionuclides Commonly used Radionuclides. Routine protocols Indication and contraindications of PET. Patient preparation technique in PET Scan.	18	CO4,CO 5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	3	2	3	2	3	2	2	3	2	3	2
CO2	3	2	3	2	3	2	3	2	3	3	2	3	2	3
CO3	2	3	2	3	2	3	2	3	2	2	3	2	3	2
CO4	2	2	1	1	3	3	3	2	2	3	2	3	3	3

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books	1. Clark's Radiography- Clark/Textbook of radiology for residents and technicians. 2.s k Bhargava Radiographic positioning- Garkal 3. Radiology- Special investigation - champman. 4. CT Made Easy
Reference Books	. Clark's Radiography- Clark/Textbook of radiology for residents and technicians. 2.s k Bhargava Radiographic positioning- Garkal 3. Radiology- Special investigation - champman.

	4. CT Made Easy

Internal Continuous Assessment:		
Component	**Marks**	**Pattern**
Terminal Exam	12	7. Contains a descriptive question of 4 marks 8. Contains 4 MCQs 9. Contains 2 short answer questions. Each question carries 2 marks
Attendance	04	
Project/Assignments	04	
Class participation or any other	04	
Class Presentation	04	
Bed Side Behavior or Interaction in Class	02	
Total Marks	30	

Department of Radiology and Imaging Techniques

Era University, Lucknow

Course Outline

Effective From 2023-24

Name of the Program	**B.R.I.T**			**Year/ Semester:**	**IV**
Course Name	**Physics of newer imaging modalities**	**Course Code:**	**BRP 401**	**Type: Semester**	**Practical**
Credits	**03**			**Total Sessions Hours:**	**60**
Evaluation Spread	**Internal Continuous Assessment:**	**30**		**End Term Exam:**	**70**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography with using newer modalities of radiology. At the end of the course, the student should be able to know about ultrasonography Computed Tomography, Generation of CT Scanner, Magnetic resonance imaging, fusion imaging PET, Contrast media using, handling and teleradiology.				
Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*					
Course Outcome (CO)					
CO1	Able to know Computed Tomography its principles, various generations, and advancements				
CO2	Able to know Magnetic Resonance Imaging- its principle, advancements, and applications.				
CO3	Explain and be able to know Ultrasonography, Color Doppler- its principle, advancements, and applications. Digital Radiography and Digital				

	subtraction angiography equipment- principle, advancements, and applications.		
CO4	Able to know Fusion Imaging including PET-CT, PET, and PET-MRI. Digital Mammography, DEXA equipment- principle, advancements, and applications.		
CO 5	Able to know tele radiology HIS, RIS, and PACS, Image processing in digital radiography systems; And processing techniques in console using CR, DR, and flat panel fluoroscopy systems.		
Pedagogy	Explanations by the Instructor, Group/Pair Work, Discussion, Assignment, Practical, Presentations.		
Internal Evaluation Mode	Terminal Exam, Attendance, Project/Assignment, Class participation, Class presentation, Bedside behavior or Interaction in class.		
Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	Basic principle of CT scan, history of CT Scan, EMI, advantages and disadvantages, Equipment description.	10	CO 1, 2
Unit 2	Scanning principle, Image acquisition, Image reconstruction, Image manipulation, Image display and documentation, Scanning parameters. Advantages and disadvantages.	10	CO 1,2

Unit 3	History of MRI, Magnetism, Basic Principle, 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	10	CO 2,3
Unit 4	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	15	CO 2,3,4
Unit 5	Benefits vs risk or PET-CT and PET-MRI. Characteristics and half-life of Radionuclides Commonly used Radionuclides. Routine protocols Indication and contraindications of PET. Patient preparation technique in PET Scan.	15	CO 4, 5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	3	2	3	3	2	2	3	2	3	2	3
CO2	3	2	3	2	3	3	2	3	3	2	3	2	3	2
CO3	2	3	2	3	2	2	3	2	2	2	1	2	2	3
CO4	3	3	2	3	3	3	2	3	3	3	3	2	3	2
CO 5	2	3	2	2	3	2	3	2	3	2	3	3	2	2

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books	1.Clark's Radiography- Clark/ Text book of radiology for residents and technicians. 2.s k bhargava Radiographic positioning- Garkal 3. Radiology- Special investigation - champman. 4. CT made Easy
Reference Books	.Clark's Radiography- Clark/ Text book of radiology for residents and technicians. 2.s k bhargava Radiographic positioning- Garkal

	3. Radiology- Special investigation - champman. 4. CT made Easy
Para Text	.Clark's Radiography- Clark/ Text book of radiology for residents and technicians. 2.s k bhargava Radiographic positioning- Garkal 3. Radiology- Special investigation - champman. 4. CT made Easy

Internal Continuous Assessment:		
Component	**Marks**	**Pattern**
Terminal Exam	12	10. Contains a descriptive question of 4 marks 11. Contains 4 MCQs 12. Contains 2 short answer questions. Each question carries 2 marks
Attendance	04	
Project/Assignments	04	
Class participation or any other	04	
Class Presentation	04	
Bed Side Behavior or Interaction in Class	02	
Total Marks	30	

Department of Radiology and Imaging Techniques Era University, Lucknow

Course Outline

Effective From 2023-24

Name of the Program	**BRIT**			**Year/ Semester:**	**IV**
Course Name	**Quality control in radiology and patient safety**	**Course Code:**	**BRT 404**	**Type: Semester**	**Theory**
Credits	**03**			**Total Sessions Hours:**	**40**
Evaluation Spread	**Internal Continuous Assessment:**	**30**		**End Term Exam:**	**70**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography. At the end of the course, the student should be able to: 1. Radiation protection 2. Biological effects of radiation 3. Planning of radiation installation-protection primary & and secondary radiation 4-Personnel monitoring systems				
Course Outcomes (CO): *After the successful course completion, learners will develop the following attributes:*					
Course Outcome (CO)					
CO1	Enumerate the guidelines of all respective organizations. Enumerate the risks and effects of the radiation.				
CO2	Label and demonstrate how to use and care for all types of lead aprons				
CO3	Demonstrate the handling and how to use TLDs and badges as per guidelines				
Pedagogy	Explanations by the Instructor, Group/Pair Work, Discussion, Assignment,				

	Practical, Presentations.		
Internal Evaluation Mode	Terminal Exam, Attendance, Project/Assignment, Class participation, Class presentation, Bedside behavior or Interaction in class.		
Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	Objectives of quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; maintain the various diagnostic and imaging units at their optimal performance. Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance. Quality assurance program at the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X-ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography; Computed tomography; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging- image distortion for digital imaging devices. LASER printer calibration.	05	CO 1
Unit 2	Quality assurance program tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, and annual - machine calibration. Basic concepts of quality assurance - LASER printer - Light beam alignment; X-ray out-put and beam quality check; KVp check; Focal spot size and angle measurement; Timer check; mAs test; Grid alignment test; High and low contrast resolutions; Mechanical and electrical checks; Cassette leak check; Proper screen-film contact test; Safe light test; Radiation proof test; Field alignment test for fluoroscopic device; Resolution test;	05	CO 2

	Phantom measurements - CT, US and MRI.		

Unit 3	Quality assurance of film and image recording devices: Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion; Artifacts of films and image recording. Monitor calibration. SMPTE pattern 6. Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, and 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 program. Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.	10	CO 2,3
Unit 4	Radiation safety in diagnostic Radiology 1. Radiation Quantities and Units: Radiation- Radioactivity- Sources of radiation - natural radioactive sources - cosmic rays terrestrial radiation - - man-made radiation sources. Units of radiation - Quality factor - Flux- Fluence-Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits - Dose limits to public.	05	CO 1
Unit 5	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-LOSO - factors affecting radio sensitivity. Biological effects of non- ionizing radiation like ultrasound, lasers, IR,	10	CO 1, 2

	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. Measuring systems - free air ionization chamber - thimble ion chamber - condenser chamber - Secondary standard dosimeters - film dosimeter - chemical dosimeter- Thermoluminescent Dosimeter. -Pocket dosimeterRadiation survey meter- wide range survey meter -zone monitor-contamination monitor their principle function and uses. Advantages & disadvantages of various detectors & the appropriateness of different detectors for different types 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 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.		
Unit 6	Radiation Hazard evaluation and control: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Workload, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning considerations for radiology, including Use factors, occupancy factors, and different shielding materials.	05	CO 3

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	3	2	3	2	3	2	3	2	2	2	3

CO2	2	2	3	2	2	2	1	2	3	2	3	2	3	2
CO3	3	3	2	3	3	2	2	2	2	2	2	3	2	2

Strong contribution-3, Average contribution-2 , Low contribution-1,

Internal Continuous Assessment:			
Component	**Marks**	**Pattern**	
Terminal Exam	12	13. Contains a descriptive question of 4 marks 14. Contains 4 MCQs 15. Contains 2 short answer questions. Each question carries 2 marks	2
Attendance	04		
Project/Assignments	04		
Class participation or any other	04		
Class Presentation	04		
Bed Side Behavior or Interaction in Class	02		
Total Marks	30		

Department of Radiology and Imaging Techniques Era University, Lucknow

Course Outline

Effective From 2023-24

Name of the Program	**BRIT**			**Year/ Semester:**	**IV**
Course Name	**Quality control in radiology and radiation safety**	**Course Code:**	**BRP 404**	**Type: Semester**	**Practical**
Credits	**03**			**Total Sessions Hours:**	**60**
Evaluation Spread	**Internal Continuous Assessment:**	**30**		**End Term Exam:**	**70**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	This course is designed to provide the students the basic knowledge in Radiography. At the end of the course, the student should be able to: 1. Radiation protection 2. Biological effects of radiation 3. Planning of radiation installation-protection primary & and secondary radiation 4-Personnel monitoring systems				
Course Outcomes (CO): *After the successful course completion, learners will develop the following attributes:*					
Course Outcome (CO)					
CO1	Enumerate the guidelines of all respective organizations. Enumerate the risks and effects of the radiation.				
CO2	Label and demonstrate how to use and care for all types of lead aprons				

CO3	Demonstrate the handling and how to use TLDs and badges as per guidelines		
Pedagogy	Explanations by the Instructor, Group/Pair Work, Discussion, Assignment, Practical, Presentations		
Internal Evaluation Mode	Terminal Exam, Attendance, Project/Assignment, Class participation, Class presentation, Bedside behavior or Interaction in class.		
Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	Knowledge of all hazards, education of general Public by posters and seminars.	15	CO1 ,CO 2
Unit 2	Safety of women and children, pregnant women, safety of patient attendants, radiation workers and hospital staff, checking of lead aprons, leakage radiation from tube head, radiation survey in and around X - ray installation.	15	CO2 ,CO 3

Unit 3	Use of TLD film badges, **GM** counters, Scintillation detectors, Liquid scintillator, Pocket dosimeters and use of protective devices etc. Keeping of dose records of radiation workers, steps after high exposure report and investigations.	15	CO1,CO 2
Unit 4	Biological effects of radiation- The cell effect of ionizing radiation on cell.	15	CO2,CO 3
Unit 5	Somatic effects and hereditary effect. Stochastic and deterministic effect.	15	CO2,CO 3

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	2	3	2	3	2	3	2	2	1	2
CO2	3	2	2	3	3	2	3	2	3	2	3	2	2	3
CO3	2	3	3	2	3	2	2	2	3	2	3	1	2	2

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books	7. CLARK
Reference Books	1. CLARK

Internal Continuous Assessment:

Component	Marks	Pattern
Terminal Exam	12	16. Contains a descriptive question of 4 marks 17. Contains 4 MCQs 18. Contains 2 short answer questions. Each question carries 2 marks
Attendance	04	
Project/Assignments	04	
Class participation or any other	04	
Class Presentation	04	

Bed Side Behavior or Interaction in Class	02	
Total Marks	30	