

STUDY & EVALUATION SCHEMES

OF

**BACHELOR OF SCIENCE IN RADIOLOGICAL
IMAGING TECHNOLOGY (B.Sc. RIT)**

(BRIT- IV SEMESTER)

[Applicable w.e.f. Academic Session 2020-21]



INTEGRAL UNIVERSITY, LUCKNOW

DASAULI, P.O. BAS-HA KURSI ROAD, LUCKNOW – 226026

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**Syllabus approved by Board of Study, Faculty Board, Academic Council,
Executive Council of the Integral University, Lucknow**

INTEGRAL UNIVERSITY, LUCKNOW
INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH
 Department of Paramedical Health Sciences & Research
STUDY & EVALUATION SCHEME
B.Sc. in RADIOLOGICAL IMAGING TECHNOLOGY (BRIT)
 (w.e.f. Session 2020-21)

II-Year

IV-Semester

S. No.	Code	Name of the Subject	Periods			Credits C	Evaluation Scheme				Subject Total
			L	T	P		Sessional			Exam	
							CT	TA	Total	ESE	
1.	RT210	Conventional Radiographic Techniques- Part II	2	1	0	3	40	20	60	40	100
2.	RT211	Special Radiographic Procedure	2	1	0	3	40	20	60	40	100
3.	RT212	Basics of USG and Mammography	2	1	0	3	40	20	60	40	100
4.	RT213	Basics of C T Scan	2	1	0	3	40	20	60	40	100
5.	RT214	Orientation in Par Clinical Sciences	2	1	0	3	40	20	60	40	100
6.	RT215	Conventional Radiographic Techniques- Part II Lab	0	0	2	1	40	20	60	40	100
7.	RT216	Special Radiographic Procedure-Lab	0	0	2	1	40	20	60	40	100
8.	RT217	Basics of C T Scan-Lab	0	0	2	1	40	20	60	40	100
9.	RT218	Hospital Posting	0	0	14	7	40	20	60	40	100
		Total	10	05	20	25	360	180	540	360	900

L: Lecture

T: Tutorials

P: Practical

C: Credit

CT: Class Test

TA: Teacher Assessment

ESE: End Semester Examination

Sessional Total: Class Test + Teacher Assessment

Subject Total: Sessional Total + End Semester Examination (ESE)

SUBJECT: CONVENTIONAL RADIOGRAPHIC TECHNIQUES- PART II
SUBJECT CODE: RT210
(w.e.f. Session 2020)

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2 1 0

LEARNING OBJECTIVE:

The main objective is to aware the student about the conventional technique of radio imaging technique like (manual image processing & fluoroscopy / dynamic imaging) along with the image formation, developing and reading.

UNIT-I PORTABLE & MOBILE EQUIPMENTS: (8 Hours)

1. Portable X-Ray Equipments Mains requirements.
2. Cable connections to wall plugs Mobile X-Ray Equipments.
3. Ray Equipments for the Operating Theatre.

UNIT- II FLUOROSCOPY EQUIPMENTS: (8 Hours)

1. Construction & Working principles of Image Intensifier.
2. Direct Fluoroscopy.
3. Viewing the Intensified image.
4. Recording the intensified Image.
5. Digital fluoroscopy.

UNIT-III FLUOROSCOPIC / RADIOGRAPHIC TABLES: (8 Hours)

1. General features of fluoroscopic / radiographic table.
2. The serial changer.
3. Remote control table.
4. The spot film devices.

UNIT-IV TOMOGRAPHIC EQUIPMENT: (8 Hours)

1. Principles of tomography.
2. Various types of tomographic movement.
3. Equipment for tomography.

UNIT-V EQUIPMENT FOR CRANIAL AND DENTAL RADIOGRAPHY: (8 Hours)

1. The skull table.
2. General Dental X-ray equipment.
3. Pan tomography equipment.
4. Equipment for Cranial & skeletal radiography.
5. Direct and Indirect Radiography.

LEARNING OUTCOME:

At the end of the course, the students will have knowledge on:

- Mobile x-ray equipments and its application.
- Tomography equipments and its principles.
- Dental radiographic equipments and its applications.

RECOMMENDED BOOKS:

1. Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins; 1990.
2. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar20.
3. Curry TS, Dowdey JE, Murray RC. Introduction to the physics of diagnostic radiology.
4. Adam A, Dixon AK, Gillard JH, Schaefer-Prokop C, Grainger RG, Allison DJ. Grainger & Allison's Diagnostic Radiology E-Book. Elsevier Health Sciences.
5. D N and M O Chesney- X ray equipments for student radiographers- Third edition
6. Burgener FA, Kormano M. Differential diagnosis in conventional radiology.

SUBJECT: SPECIAL RADIOGRAPHIC PROCEDURES
SUBJECT CODE: RT211
(w.e.f. Session 2020)

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2 1 0

LEARNING OBJECTIVE:

The objective is to learn contrast imaging techniques under the guidance of fluoroscopy, administration of contrast media and its safety aspect.

Indications, contraindications, procedure and technique of all procedures

UNIT-I: (8Hours)

Introduction to Radiographic Special Procedures:

Contrast Media- Application, types, safety aspects & administration, Reaction to contrast media and management of contrast reactions.

UNIT-II: (8Hours)

1. Barium swallow, Barium meal
2. Barium meal follow through(BMFT)
3. Barium enema

UNIT-III: (8Hours)

1. Intravenous urogram (IVU).
2. Micturating Cystourethrogram (MCU).
3. Ascending Urethrogram (ASU)/RGU.
4. Hysterosalpingography (HSG).

UNIT-IV: (8Hours)

1. Myelography
2. ERCP/ PTBD,
3. PTC, T-tube cholangiography

UNIT- V: (8Hours)

1. Sialography,
2. Dacrocystography,
3. Sinogram,
4. Fistulogram,
5. FNAC
6. Biopsy

LEARNING OUTCOME:

At the end of the course, student will have knowledge on:

- Barium enhanced Gastrointestinal tract studies
- Iodinated contrast media enhanced urinary tract and female reproductive system studies
- Interventional procedures of different ducts, fluid aspiration & tissue extraction.

RECOMMENDED BOOKS:

1. Lakhkar B N, Banavali S, Shetty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.
2. Snopek AM. Fundamentals of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.
3. Davies SG, Chapman S. Aids to radiological differential diagnosis. Elsevier Health Sciences; 2013 Nov 20.
4. Krishnamurthy, Medical Radiographic Technique & Darkroom Practice.

SUBJECT: BASICS OF ULTRASONOGRAPHY AND MAMMOGRAPHY
SUBJECT CODE: RT212

(w.e.f. Session 2020)

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LEARNING OBJECTIVE-

The objective is to learn basic knowledge on ultrasound and Doppler equipments for various imaging and equipments used for breast imaging and mammography techniques.

UNIT-1 INTRODUCTION TO ULTRASOUND IMAGING: (8 Hours)

Sound, Ultrasound, Attenuation, Echoes, Basic principle of Ultrasound imaging, Advantages and disadvantages

UNIT-II INSTRUMENTATION OF ULTRASONOGRAPHY: (8 Hours)

Controls of Ultrasound Equipment, USG probes, Coupling agent, Cathode ray tube, Image display, USG contrast agent. **Piezoelectric Effect-** Definition, Types of element, Properties.
Transducers: Construction and operation, Types of transducers

UNIT-III USG DISPLAY MODES: (8 Hours)

USG Display modes: A mode, B mode, M mode, TM mode.
Gray scale imaging Beam focusing, Resolution

UNIT-IV DOPPLER USG: (8 Hours)

Principle, Doppler Effect, Color Doppler, Continuous wave Doppler, Pulsed wave Doppler.
USG Bio effects, safety.
Mamography: Mammography Equipments and Basic views in Mammography.

UNIT V CLINICAL PRACTICE: (8 Hours)

Scanning protocol, Indication, Patient preparation, image quality and artifacts in Ultrasound and Mammography,

LEARNING OUTCOME-

At the end of the course, student will be able to assist the radiologist and sinologist on:

1. Transducer selection
2. Patient selection and preparation
3. Managing image quality and artefacts in USG and mammography
4. Sufficient knowledge about contrast media selection and its adverse effect.

RECOMMENDED BOOKS:

1. Zwiebel WJ, Sohaey R. Introduction to ultrasound. WB Saunders Company; 1998.
2. Hagen-Ansert SL. Textbook of diagnostic ultrasonography. Mosby Elsevier; 2006.
3. Basics of Ultrasonography for Radiographers and Technologists- Latest edition
4. Tucker AK, Ng YY. Textbook of mammography. Churchill Livingstone; 2001.
5. Wentz G, Parsons WC. Mammography for radiologic technologists. McGraw-Hill, Health Professions Division; 1997.

SUBJECT: BASICS OF COMPUTED TOMOGRAPHY
SUBJECT CODE: RT213
(w.e.f. Session 2020)

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LEARNING OBJECTIVE:

The objective is to induce idea on cross sectional imaging of different anatomical area along with the pathologies.

UNIT-I INTRODUCTION TO COMPUTED TOMOGRAPHY AND PRINCIPLE OF COMPUTED TOMOGRAPHY- (8 Hours)

1. History, Advantage and Disadvantages of CT, Basic principle of CT
2. **Generations of Computed Tomography-** 1st generation, 2nd generation, 3rd generation, Slip ring technology, 4th generation, Electron beam CT, Dual Source CT, Flat Panel Detector CT Single and Multi slice Technology.

UNIT-II INSTRUMENTATION: (8 Hours)

1. CT scanner gantry, Detectors & Data Acquisition System, Generator, Computer and image processing.
2. System Image display system, storage, recording and communication system, CT control console, Options and accessories for CT systems.

UNIT-III IMAGE RECONSTRUCTION, IMAGE DISPLAY AND IMAGE QUALITY: (8 Hours)

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

UNIT-IV CT ARTEFACTS: (8 Hours)

CT Artefacts- Classification, Types, Causes, Remedies

UNIT-V DIAGNOSTIC ASPECTS OF CT AND POST PROCESSING TECHNIQUES: (8 Hours)

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

LEARNING OUTCOME:

At the end of the course, student will have knowledge on:

- Working principle, construction & clinical application of Computed Tomography.
- CT instrumentation – gantry system, console system, recording and display system.
- Image reconstruction technique – pre and post processing technique.

RECOMMENDED BOOKS:

1. Seeram E. Computed Tomography-E-Book: Physical Principles, Clinical Applications and Quality Control. Elsevier Health Sciences; 2015 Sep 2.
2. Seeram E. Computed tomography: physical principles and recent technical advances. Journal of Medical Imaging and Radiation Sciences. 2010.
3. Kak AC, Slaney M. Principles of computerized tomographic imaging. Society for Industrial and Applied Mathematics; 2001 Jan 1.
4. Hsieh J. Computed tomography: principles, design, artifacts, and recent advances. SPIE press; 2003.
5. Shaw CC, editor. Cone beam computed tomography. Taylor & Francis; 2014 Feb 14.

SUBJECT: ORIENTATION IN PAR CLINICAL SCIENCES

SUBJECT CODE: RT214

(w.e.f. Session 2020)

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2 1 0**

LEARNING OBJECTIVE:

The objective is to learn basic pathological conditions related to cardiology, surgery, nephrology, orthopedic, gastrology, neurology and general medicine for the diagnosis.

UNIT-I

(8 Hours)

1. Pericarditis
2. Valvular diseases
3. Rheumatic Heart Disease
4. Heart failure
5. Bronchitis
6. Emphysema
7. Bronchitis
8. Pneumonia
9. Tuberculosis
10. Pleura effusion
11. Phenumo thorax

UNIT-II

(8 Hours)

1. Aclasia cardia
2. Peptic ulcer
3. Intestinal obstruction
4. Crohn's disease
5. Ulcerative colitis
6. Pancreatitis
7. Portal Hypertension
8. Ascitis
9. Cirrhosis
10. Cholecystitis
11. Melena
12. Appendicitis

UNIT-III

(8 Hours)

1. Hematuria
2. UTI
3. Hydronephrosis
4. Horse shoe Kidney
5. Hydrocele

6. Glomerulo nephritis
7. Nephrotic Syndrome
8. Urinary calculi
9. Polycystic Kidney disease
10. Renal failure

UNIT-IV

(8 Hours)

1. Fracture
2. Type Mechanism, Healing, Delayed Union, Non- complication
3. Injuries of the shoulder girdle, Dislocation of shoulder
4. Injuries of the carpal
5. Dislocation of Hip
6. Femur, Tibia, Ankle, calcaneum
7. Acute & chronic osteo arthritis
8. Rhematoid arthritis
9. Paget's Disease
10. Ankylosing spondylitis
11. Club foot
12. Bone Tumour-Benign Malignant
13. Perthes diseases

UNIT- V

(8 Hours)

1. Cholelithiasis
2. Peritonitis
3. Suprahrenic Abscess
4. Appendicitis
5. Benign Hypertrophy prostate

LEARNING OUTCOME:

At the end of the course, student will be expert handling patients with different disease condition referred to radiology department. Knowledge to allocate the patients to various modalities according to their pathological condition.

RECOMMENDED BOOKS:

1. Kumar V, Abbas AK, Fausto N, Aster JC. Robbins and Cotran Pathologic Basis of
2. Disease, Professional Edition E-Book. Elsevier Health Sciences; 2014 Aug 27.
3. Mohan H. Textbook of pathology. New Delhi: Jaypee brothers medical publishers
4. Boyd W. A Textbook of Pathology: An Introduction to Medicine. Academic Medicine.
5. Davidsohn I, Henry JB, Todd JC. Todd-Sanford clinical diagnosis by laboratory methods.

SUBJECT: CONVENTIONAL RADIOGRAPHIC TECHNIQUES-PART II LAB
SUBJECT CODE: RT215
(w.e.f. Session 2020)

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LEARNING OBJECTIVE:

The main objective is to aware the student about the conventional technique of radio imaging technique like (manual image processing & fluoroscopy / dynamic imaging) along with the image formation, developing and reading and also handling the equipments.

1. Portable & Mobile Equipments
2. Fluoroscopy Equipments
3. Fluoroscopic / Radiographic Tables
4. Tomographic Equipment
5. Equipment for Cranial And Dental Radiography

LEARNING OUTCOME:

At the end of the course, the students will have knowledge on:

- Mobile x-ray equipments and its application.
- Tomography equipments and its principles.
- Dental radiographic equipments and its applications.

RECOMMENDED BOOKS:

7. Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic cardiology. Lippincott Williams & Wilkins; 1990.
8. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar20.
9. Curry TS, Dowdey JE, Murray RC. Introduction to the physics of diagnostic radiology.
10. Adam A, Dixon AK, Gillard JH, Schaefer-Prokop C, Grainger RG, Allison DJ. Grainger & Allison's Diagnostic Radiology E-Book. Elsevier Health Sciences.
11. D N and M O Chesney- X ray equipments for student radiographers- Third edition
12. Burgener FA, Kormano M. Differential diagnosis in conventional radiology.

SUBJECT: SPECIAL RADIOGRAPHIC PROCEDURES- LAB
SUBJECT CODE: RT216
(w.e.f. Session 2020)

L T P
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LEARNING OBJECTIVE:

The objective is to learn contrast imaging techniques under the guidance of fluoroscopy, administration of contrast media and its safety aspect.

COURSE CONTENT:

1. Radiography of Special radiological procedures, using contrast media as per syllabus.
2. Positioning, Patient preparation, assistance while performing procedures.

LEARNING OUTCOME:

At the end of the course, student will have knowledge on:

- Barium enhanced Gastrointestinal tract studies
- Iodinated contrast media enhanced urinary tract and female reproductive system studies
- Interventional procedures of different ducts, fluid aspiration & tissue extraction.

RECOMMENDED BOOKS:

1. Lakhkar B N, Banavali S, Shetty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.
2. Snopek AM. Fundamentals of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.
3. Davies SG, Chapman S. Aids to radiological differential diagnosis. Elsevier Health Sciences; 2013 Nov 20.
4. Krishnamurthy, Medical Radiographic Technique & Darkroom Practice.

SUBJECT: BASICS OF COMPUTED TOMOGRAPHY- LAB
SUBJECT CODE: RT217
(w.e.f. Session 2020)

L T P
0 0 2

COURSE CONTENT:

1. Patient preparation, patient positioning, performing all non-contrast and contrast computed tomography procedures.
2. Radiation protection and care of patient during procedures including contrast media Management in CT.
3. Various post processing techniques and evaluation of image quality and clinical findings. Post procedural care of the patient.

LEARNING OUTCOME:

At the end of the course, student will have knowledge on:

- Working principle, construction & clinical application of Computed Tomography.
- CT instrumentation – gantry system, console system, recording and display system.
- Image reconstruction technique – pre and post processing technique.

RECOMMENDED BOOKS:

1. Seeram E. Computed Tomography-E-Book: Physical Principles, Clinical.
2. Applications and Quality Control. Elsevier Health Sciences; 2015 Sep 2.
3. Seeram E. Computed tomography: physical principles and recent technical advances.
4. Journal of Medical Imaging and Radiation Sciences. 2010.
5. Kak AC, Slaney M. Principles of computerized tomographic imaging. Society for Industrial and Applied Mathematics; 2001 Jan 1.
6. Hsieh J. Computed tomography: principles, design, artifacts, and recent advances.
7. SPIE press; 2003.
8. Shaw CC, editor. Cone beam computed tomography. Taylor & Francis; 2014 Feb 14.

SUBJECT: HOSPITAL POSTING
SUBJECT CODE: RT218
(w.e.f. Session 2020)

L T P
0 0 14

COURSE CONTENT:

Students shall be deputed to various labs of Radiology department wherein they shall undergo practical training of handling patients, collection and processing of data, samples, radiograph, & probable diagnosis. Identification of patient's particulars based on CR number, Lab Number. Process of performing various tests in different lab, like CT labs, USG Labs, MRI Lab, X-ray lab. Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.