BACHELOR OF PARA MEDICAL TECHNOLOGY (BPMT)

Course Name:- Radiography

Learning Objectives

1st Year

By the end of the course, the student should be able to:

1. Perform all routine x-rays – mobile and steady, medicolegal x-rays, poly-trauma x-rays.
2. Assist all conventional procedures like IVP, IU, MCU, Barium procedures, HSG, etc.
3. Perform all plain CT Scan of whole body.
4. Assist in CECT, CT angio and CT guided procedures.
5. Perform all plain MRI scans.
6. Assist in contrast enhanced MRI's, specialised MR sequences.
7. Assist in ultrasonography, in record keeping and patient preparation.*
8. Perform CPR in case of emergencies in department.
9. Describe the radiation hazards, radiation safety issues and relevant administrative issues.

*** Only limited teaching.**

Practical examinations should be held in the Parent institute as students have difficulty when they have to perform practical tests on equipment different from what they have learned on

2nd Year

At the end of the course the student should be able to explain the theory and do the practical for the following topics

1) Perform basic CT Imaging of the entire body
2) Assist the radiologist in performing specialized radiological investigations like Barium studies, IVP, HSG etc.
3) Should have a basic knowledge of the working of the CT scan machine ultrasound machine,
4) Student should be aware of the PCPNDT act and should be able to assist the radiologist in the documentation required under the PCPNDT act
5) Should have a basic knowledge of CT anatomy in various planes and should be able to pick that there is some abnormality in the CT scans during scanning. Detailed knowledge of abnormality is not expected. Only an understanding that there is some abnormality in the scan should be expected.

BACHELOR OF PARA MEDICAL TECHNOLOGY (BPMT)

Course Name:- Radiography

1st Year: Assessment System & Syllabus

Sr. No	Paper	Subject	Subject Code	Theory			Practical			Total Marks
				IA	Final	Total	IA	Final	Total	
1	Paper – I	Basic Sciences - I		30	60	90	30	80	110	200
2	Paper – II	Physics and technology - II		30	60	90	30	80	110	200
3	Paper - III	Basic Imaging - III		30	60	90	30	80	110	200

Paper – I
Subject :- Basic Sciences-I

Sr. No.	Topics	Theory Hours
1	Basic knowledge of English and Computers	1
2	Introduction to Anatomy	1
3	Introduction to body parts and systems	0
4	Bones of upper limb (Only nomenclature and major parts)	3
1	Bones of lower limb (Only nomenclature and major parts)	3
2	Bones of pelvis (Only nomenclature and major parts)	1
3	Bones of skull (Only nomenclature and major parts)	3
4	Bones of vertebral column (Only nomenclature and major parts)	3
5	Bones of thorax (Only nomenclature and major parts)	1
6	Dental Anatomy	1
7	Joints and classification (Only nomenclature)	3
8	Anatomy & Functions of respiratory System (Only Organ nomenclature and brief functions)	1
9	Anatomy & Functions of cardiovascular system (Only Organ nomenclature, important arteries and veins and their branches / tributaries)	1
10	Anatomy & Functions and lymphatic drainage of Abdominal Organs , GI system (Only nomenclature and brief functions part 1 Gastrointestinal system, Part 2 Hepatobiliary system and pancreas, Part 3 Urinary system)	3
11	Anatomy & Functions of Pelvic Organs (Only nomenclature and brief functions Separately for male and female)	2
12	Anatomy & Functions of Nervous System (Only nomenclature and brief functions)	2
13	Anatomy & Functions of Endocrine glands (only nomenclature, site and brief functions)	2
14	Important Surface Landmarks – Upper Limb	1
15	Important Surface Landmarks – Lower Limb	1
16	Important Surface Landmarks – Head and Neck	1
17	Important Surface Landmarks – Thorax and abdomen	1
18	Important Surface Landmarks – Joints(already included in upper and lower limb	0
19	Important Surface Landmarks – Vertebral column	1
20	Meanings of axial, coronal, sagical and oblique planes	1
21	Introduction to neoplasia (not required for Radiography course)	0
22	Common cancers(not required for Radiography course)	0

Paper – I
Practical

Sr. No.	Topics	Hours
1	Identification of visceral organ specimens	**4**
2	Identification and function of human bones	**4**
3	Project work with charts and models of organ system	**4**
4	Demonstration of surface marking of important anatomical landmarks	**4**
5		

Paper – II
Subject :- Physics and technology - II

Sr. No.	Topics	Theory	Practical
1	Units and measurement (Topics 1-8 are very basic preliminary topics already studied by the students in 11 th and 12 th standard. Hence self study is recommended for these students	0	-
2	Electric current, AC and DC, its characters	0	-
3	Ohm's law and its application.	0	-
4	Electrical work, power, energy	0	-
5	Effects of electric current, Electrolysis	0	-
6	Magnetism: Fundamental Principles and Terminology	0	-
7	Magnetic induction, flux and demagnetization	0	-
8	Electromagnetic induction, Faradays laws	0	-
9	Mutual and self induction	1	-
10	Sound: Acoustics and wave motion.	1	-
11	Rectification: Type of rectification. Rectification : Self and half wave rectification	1	1
12	Atom, structure, atomic no, mass no, Isotopes, ionisation	1	1
13	Electromagnetic Spectrum, thermionic emission and its application	1	1
14	Interaction of Energy and Matter at the atomic level	1	-
15	Transformer: Step up and step down	1	1
16	Principles of X Ray Production	1	1
17	. Power supply to X-Ray machine, main fuse box, constructions X-Ray machine components and circuit diagram	2	2
18	Auto transformer: construction, principles and connections.	1	-
19	High-tension transformer: Construction, Principles and connections	1	-
20	. Timer : Construction , type and their proper use	1	-
21	X Ray Generators: Power Supply	1	1
22	. Construction of an X-Ray tube , Rotating anode X-Ray tube	1	1
23	Production of X-Ray . Effects of KVP & MA	1	1
24	Tube ratings and Earthing of an X-Ray machine	1	1
25	Radiation Quality: Filters and Beam Limiting Devices	1	1
26	Grids: Principles, construction, Uses and limitations	1	1
27	. Radiographic Tables: Design and Constrction	1	1
28	Mobile X-Ray unit : Design and Use	1	1
29	Image intensifier : Basic Principles and Construction	1	1

30	Photographic aspects of Radiography and Image formation	1	1
31	. Construction of Radiographic Film, Principles of Function of Radiographic Film Types of Radiographic Film and comparative evaluation	1	1
32	Intensifying Screen: Principles, Construction, Types,	1	1
33	Introduction to Computed Radiography system	0	1
34	Visit to CT, MRI ,DSA , Mammography in the department	0	2

Paper – III

Subject: - Basic Imaging - III

Sr. No.	Topics	Theory	Practical Hours
1.	Preparation of patient for X ray , Administrative issues with X rays	1	1
2.	Concepts of various X ray views such as AP, PA, oblique, lateral etc	1	2
3.	Concepts of mA, KV and exposure time FFD and centering	1	1
4.	Introduction to X ray machine Demonstration of various parts of X	1	1
5.	Protective equipments and their demonstration	1	1
6.	Chest X ray – Basic PA , Lateral view , Decubitus, Penetrated and	1	1
7.	Skull X ray– PA and Lateral	1	1
8.	Mandible and Tempero Mandibular joint Radiography	1	2
9.	Radiography of Mastoids Schuller s view	1	2
10.	Radiography of Nasal Bone	1	1
11.	KUB– Basic and Radiography for Intravenous Urography	2	2
12.	X ray Shoulder joint AP and Axial view	1	1
13.	Radiography of Arm and Fore arm	1	2
14.	Radiography of Thigh and Leg	1	1
15.	X ray Pelvis AP,Lateral , Frog Lateral view, Sacro Iliac joint	3	3
16.	Cervical spine X ray – Basics and various views	2	2
17.	Thoracic spine X ray – Basics and various views	1	1
18.	Lumbar spine X ray – Basics and various views	1	1
19.	X ray Elbow joint – Basics and various views	1	1
20.	X ray Wrist joint – Basics and various views	1	1
21.	X ray Knee joint – Basics and various views	1	1
22.	X ray Ankle joint – Basics and various views	1	1
23.	Radiography for Gastro Intestinal contrast studies	1	3

Revision tutorial/sessions during posting.

Practical : Observation, Rotational posting to all sections of radiology department.

BACHELOR OF PARA MEDICAL TECHNOLOGY (BPMT)
Course Name:- Radiography

2nd Year: Assessment System & Syllabus

Sr. No	Paper	Subject	Subject Code	Theory			Practical			Total Marks
				IA	Final	Total	IA	Final	Total	
1	**Paper I**	Anatomy (Cross sectional)-I		30	60	90	30	80	110	200
2	**Paper II**	Physics, Radiation Safety and Administrative issues-II		30	60	90	30	80	110	200
3	**Paper III**	Basic Imaging (CT/Ultrasound)-III		30	60	90	30	80	110	200

Paper – I
Subject :- Anatomy (Cross sectional)-I

Sr. No.	Topics	Theory	Practical Hours
1.	Introduction to concepts of cross sectional anatomy, axial, coronal and oblique planes	1	1
2.	Cross sectional Anatomy of Head and Brain (Major parts only in all planes)	3	3
3.	Cross sectional Anatomy of Neck (Major parts only)	3	3
4.	Cross sectional Anatomy of Thorax (Major parts only)	2	2
5.	Cross sectional Anatomy of Abdomen (Major parts only)	4	4
6.	Cross sectional Anatomy of Pelvis (Major parts only male pelvis and female pelvis soft tissues)	4	4
7.	Cross sectional Anatomy of Upper limb (Major parts only shoulder, elbow and wrist)	3	3
8.	Cross sectional Anatomy of Lower limb (Major parts only hip, knee and ankle)	3	3

Relevant anatomy must be explained in axial, coronal and sagittal planes

Paper – II
Subject :- Physics, Radiation Safety and Administrative Issues-II

Sr. No.	Topics	Theory	Practical Hours
	Section A		
1	Basics in Digital Radiography		
2	Computed Tomography: Basic Principles, history, tube design, generations, EBCT, X Ray Tube Design and construction Special Requirements of CT Tube, Concept of HU, Multidetector CT. Design and Construction,Its influence on Radiation Safety ,Resolution In CT CT artifacts and their detection		
3	Ultrasonography: Physical Principles , Transducer Design and Construction Types of Imaging (A Mode, B Mode, TM Mode)		

	Other aspects of ultrasound physics		
4	Colour Doppler : Fundamental Principles, Pulse Wave and Continuous Wave , Colour Map		
	Section B		
1	Image Quality: Basic Testing Procedures in Conventional Radiography		
2	Quality Assurance in Film Processing		
3	Administration: Care and Maintenance of Equipment. Log Books		
4	Disposal of Used Chemicals Bio-waste Disposal in Radiology Department		

Paper III
Basic Imaging – CT , Ultrasound

Sr. No.	Topics	Theory	Practical Hours
1	Introduction to CT scanning Fundamentals: Terminology and parts (Equipment Nomenclature and Introduction) CT Introduction: Equipment parameters- Basic, Single Slice & Spiral CT Introduction : Equipment parameters- Multidetector	1	3
2	Concepts of HU, MPR, MIP, 3D reconstruction etc	1	1
3	CT IV Contrast Use: Basics of Contrast Injecting and Use of Power Injectors	1	2
4	CT Technique: Neurocranium and Pituitary Fossa	1	2
5	CT Technique: Temporal Bone	2	2
6	CT Technique Orbit	2	2
7	CT Technique Paranasal sinuses	2	2
8	CT Technique Cervical Spine and Neck	2	2
9	CT Technique Thorax Plain and Contrast	2	2
10	CT Technique for Abdomen	3	3
11	CT Technique Female pelvis	2	2
12	CT Technique Male pelvis	2	2
13	CT Technique Cervical spine	2	2
14	CT Technique Thoracic spine	2	2
15	CT Technique Lumbar spine	2	2
16	CT Technique Lower Limbs	3	3
17	CT Technique Upper Limbs	3	3
18	CR: Equipment nomenclature and Introduction, Procedures, Documentation Artefacts ,errors , Limitations CR: Radiation Safety Features	3	3
19	DR: Equipment, Nomenclature and Introduction ,Image Acquisition , Parameters 3 Artifacts ,Errors and Radiation Safety Factors	3	3

– Every week -3 days:

- **Rotational Posting in CT**
- **Visit to CT Scan**
- **USG department**

Observational Learning: Revision of steps while showing procedure.

BACHELOR OF PARA MEDICAL TECHNOLOGY (BPMT)

Course Name:- Radiography

3rd Year: Assessment System & Syllabus

Sr. No	Paper	Subject	Subject Code	Theory			Practical			Total Marks
				IA	Final	Total	IA	Final	Total	
1	I	Physics & Technology (MRI), Image Processing and recording –I		30	60	90	30	80	110	200
2	II	Advanced Imaging (Advanced CT, MR, DSA) – II		30	60	90	30	80	110	200
3	III	Administration and Radiation Safety in Interventional Procedures, MR Safety, DICOM and PACS, Quality Assurance in Imaging. - III		30	60	90	30	80	110	200

At the end of third year the BPMT student is expected to know and perform the practicals for the following topics

1) Basic knowledge of working of MRI Machine
2) Care of the patient while performing MRI examination
3) Should be able to assist the radiologist I performing specialized procedures in CT as well as MRI
4) Should be able to do the basic daily maintenance testing of CT and MRI machine
5) Should know how to maintain records in the Radiology Department
6) Should be able to do portabale radiography for ward patients and emergency Radiography

Paper – I

Subject:-Physics & Technology (MRI), Image Processing and recording – I

Sr. No.	Topics	Theory	Practical Hours
	Physics & Technology (MRI)		
	Section A		
1	MRI Technology		
2	The Magnetic Resonance Phenomenon	2	2
3	Basics of MR Image Formation	2	2
4	Design & Construction of Components of Scanner	2	2
5	RF Coils	1	1
6	Image Formation Process	1	1
7	The Basic MR Sequences	3	3
8	Advanced MR Sequences	1	1
9	MRI Technology : Parallel Processing	1	1
10	MRI Technology : BOLD imaging and Functional MRI	1	1
11	MRI Technology : Perfusion Imaging	1	1
12	MRI Technology : MR Spectroscopy	1	1

13	Imaging Parameters and Their effect on Image acquired	1	1

Only Basics of MRI, CT, USG, X-Ray required.

Paper – II
Subject: - Advanced Imaging (Advanced CT, MR, DSA) – II

Sr. No.	Topics	Theory	Practical Hours
1	Radiography in Ortho paedics	3	3
2	Radiography In Polytrauma	3	3
3	Radiography In Disaster Situation	2	2
4	Radiography In ICU	3	3
5	Radiography In Operation Theater	3	3
6	C Arm Use in Operation Theater	3	3
7	Radiography of Scoliosis	2	2
8	Skeletal Survey	1	1
9	Mammography Basics	2	2
10	CT Techniques : Musculoskeletal CT basics	2	2
11	PET-CT: Introduction, Basic Equipment and Procedure 3	3	3
12	PET CT: Image Acquisition and Processing	1	1
13	MRI : Introduction to MRI Procedure	2	2
14	MRI Technique: Terminology and Parts of Equipment	2	2
15	MRI Technique: Coils	2	2
16	MRI Technique: Pressure Injector	2	2
17	MRI Technique: MR Contrast Media	2	2
18	MRI Technique: MR Patient Safety procedure	2	2
19	MRI Technique: MR Equipment Safety	2	2
20	MRI Technique: Basic MR sequences and Clinical Implications	1	1
21	MRI Technique: Brain Basic	2	2
22	MRI Technique: Brain for Cerebrovascular Accident	2	2
23	MRI Technique: Perfusion Technique	1	1
24	MRI Technique: Epiplepsy	1	1
25	MRI Technique: Inner Ear	1	1
26	MRI Technique: Orbit	1	1
27	MRI Technique: Sella	1	1
28	MRI Technique: Cervical Spine	1	1
29	MRI Technique: Dorsolumbar Spine	1	1
30	MRI Technique: Lumbosacral Spine	1	1
31	MRI Technique: Post-Operative Spine	1	1
32	MRI Technique: Spinal Trauma	1	1
33	MRI Technique: Sacroiliac Joints	1	1
34	MRI Technique: Kidneys and MR Urography	1	1
35	MRI Technique: Female Pelvis	1	1
36	MRI Technique: Male Pelvis	1	1
37	MRI Technique: Adrenal Gland	1	1
38	MRI Technique:Temporomandibular Joints	1	1
39	MRI Technique: Shoulder Joint	3	3
40	MRI Technique: Elbow Joint	1	1
41	MRI Technique: Wrist Joint and Hand	1	1
42	MRI Technique: Hip Joints	1	1
43	MRI Technique: Knee Joint	3	3
44	MRI Technique: Ankle Joint and Foot	1	1
45	Colour Doppler Imaging Basics	1	1
46	DSA Patient Care : (i) Patient preparation (ii) Patient reception	2	2

	(iii) Patient care during and after procedure		
47	Intra-Procedural Management : (i) Patient positioning, cleaning and draping (ii) Trolley and disposables (iii) Drug administration and recording (iv) Managing the equipment and assisting the radiologist	2	2
48	Equipment Related (i) Basic Hardware (ii) Fluoroscopy and DSA	1	1
49	Maintaining Patient Records	1	1

Paper – III

Subject: - Administration and Radiation Safety in Interventional Procedures, MR Safety, DICOM and PACS, Quality Assurance in Imaging.

Sr. No.	Topics	Theory	Practical Hours
1	Radiation safety In The Fluoroscopy Suite 2 2	2	2
2	Radiation Dosage Monitoring and TLD Service Methodology 2 2	2	2
3	MR Safety Considerations 2 2	2	2
4	MR Safety for Patients 2 2	2	2
5	MR Compatibility of Implants 2 2	2	2
6	DICOM Standard 3 3 : Introduction Components of the DICOM standard DICOM Compatibility of Equipment and DICOM Licensing DICOM Functions	3	3
7	PACS : Introduction Components Types and Architecture : Maintenance and Security Future Directions How to assess a PACS system PACS and EMR : Electronic Medical Records Standards	4	4
8	Quality Assurance in CT scanning	1	1
9	Quality Assurance in MRI	1	1
10	Medico- legal issues in Medical Record Keeping	2	2
11	Occupational Health: Hazards in Radiographic and Imaging Technology	1	1
12	Electrical Safety	1	1
13	Radiation Safety : Principles of Radiobiology , Current Regulations and Standards ,: Indian Regulations and Procedures Administrative Aspects Dosimeters and their use Protective Equipments and Procedural Techniques)	3	3
14	Administration: Record Keeping and Documentation	1	1
15	Administration: Inventory Management	1	1
16	Administration: PCPNDT Act		

BACHELOR OF PARA MEDICAL TECHNOLOGY (BPMT)

Course Name: - Radiography

List of Suggested Books for reading

Sr. No.	Subject / Topic	Author/ Editor	Title of Book	Publisher
1	Anatomy	Paul Butler	Applied Radiological Anatomy for Medical Students	Cambridge University Press
2	Radiography	A. Stewart Whitney and others	Clark's Positioning in Radiography 12 th Edition	Hodder Arnold Press
3	Physics	Joseph Selman	The Fundamentals of X –ray & Radium Physics Eight Edition	Charls C Thomas
4	Ultrasound	Carol Rumack	Diagnostic Ultrasound Vol. 1 Fourth Edition	Mosby
5	CT and MRI Physics	Lee, Joseph K. T.; Sagel	Computed Body Tomography with MRI Correlation , 4th Edition	Lippincott Williams & Wilkins
6	CT & MRI	Chavan Jankhariya	Cross Sectional Anatomy CT & MRI	Jaypee