CURRICULUM FOR ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY (MJ)

SCHEME - Y

DURATION: TWO YEARS **PATTERN: YEARLY**

TYPE: FULL TIME

(To be implemented from the Academic Year 2011 – 2012)

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION. MUMBAI

(AUTONOMOUS)

ISO 9001-2008 Certified

49, Kherwadi, Aliyawer Jung Marg, Mumbai – 400 051

MINIMUM STANDARD REQUIRMENTS FOR ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY

The Institution should have the following infrastructure of its own:

Basic Infrastructure:

- 150 Bedded Hospital.
- Full fledged Dark Room with accessories.
- Auto film Processor
- Mobile X-ray machine.
- X-ray machine - 200 mAs.
- X-ray machine with II TV.
- C-arm X-ray machine.
- Ultrasound machine.
- Mammography machine.
- OPG machine.
- Multislice CT scan machine.
- MRI machine - 1 Tesla.

Staff Requirements:

Teaching Staff: -

- Professors with MD (Radio-diagnosis) – 2 Nos
- Medical Physicist - 1 No.

Tutor/demonstrator Technical Staff: - Minimum four with the following qualifications

- B. Sc Radiography or Diploma in Radiography with minimum of 5 years experience in the related field.

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

TEACHING AND EXAMINATION SCHEME

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY

COURSE CODE : MJ

DURATION OF COURSE : 2 YEARS **WITH EFFECT FROM 2011-12**

YEAR : FIRST YEAR **DURATION : 32 WEEKS**

PATTERN : FULL TIME – YEARLY **SCHEME : Y**

SR. NO.	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME									
				TH	TU	PR	PAPER HRS	TH (01)		PR (04)		OR (08)		TW (09)		SW (16009)
								Max	Min	Max	Min	Max	Min	Max	Min	
1	Physics for Medical Imaging	PMI	13739	02	--	05	03	100	50	50@	25	--	--	--	--	
2	Equipment for Medical Imaging - I	EMI	13740	02	--	05	03	100	50	50@	25	--	--	--	--	
3	Radiological Science & Dark Room Techniques	RSD	13741	01	--	05	03	100	50	50@	25	--	--	--	--	
4	Introduction to Anatomy	IAN	13742	02	--	--	03	100	50	--	--	--	--	--	--	100
5	Introduction to Physiology & Pathology	IPP	13743	02	--	--	03	100	50	--	--	--	--	--	--	
6	Patient Care in Radiography	PCR	13744	02	--	--	03	100	50	--	--	--	--	--	--	
7	Basic Radiographic Techniques - I	BRT	13745	02	--	05	03	100	50	50#	25	--	--	50@	25	
8	Seminar	SEM	13746	01	--	--	--	--	--	--	--	50@	25	--	--	
			TOTAL	**14**	**--**	**20**	--	**700**	**--**	**200**	**--**	**50**	**--**	**50**	**--**	**100**

Student Contact Hours Per Week: **34 Hrs.**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.

Total Marks **: 1100**

@ Internal Assessment, # External Assessment, [ ] No Theory Examination.

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Termwork, SW- Sessional Work

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 100 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

TEACHING AND EXAMINATION SCHEME

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY

COURSE CODE : MJ

DURATION OF COURSE : 2 YEARS **WITH EFFECT FROM 2011-12**

YEAR : FIRST YEAR **DURATION : 32 WEEKS**

PATTERN : FULL TIME – YEARLY **SCHEME : Y**

SR. NO.	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME									
				TH	TU	PR	PAPER HRS	TH (01)		PR (04)		OR (08)		TW (09)		SW (16010)
								Max	Min	Max	Min	Max	Min	Max	Min	
1	Radiation Physics & Radiation Protection	RPR	13747	01	--	--	02	50	25	--	--	--	--	--	--	100
2	Equipment for Medical Imaging-II	EMI	13748	02	--	05	03	100	50	50#	25	--	--	50@	25	
3	Basic Radiographic Techniques-II	BRT	13749	02	--	05	03	100	50	50@	25	--	--	--	--	
4	Special Procedures in Medical Imaging	SPM	13750	02	--	--	03	100	50	--	--	--	--	--	--	
5	Digital Imaging	DIM	13751	02	--	--	03	100	50	--	--	--	--	--	--	
6	Modern Imaging Technology	MIT	13752	02	--	05	03	100	50	50#	25	--	--	50@	25	
7	Planning & Quality Assurance in Medical Imaging	PQA	13753	01	--	05	02	50	25	50#	25	--	--	50@	25	
8	Project	PRO	13754	02	--	--	--	--	--	--	--	--	--	50@	25	
			TOTAL	**14**	**--**	**20**	--	**600**	**--**	**200**	**--**	**--**	**--**	**200**	**--**	**100**

Student Contact Hours Per Week: **34 Hrs.**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.

Total Marks **: 1100**

@ Internal Assessment, # External Assessment, [ ] No Theory Examination.

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Termwork, SW- Sessional Work

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 100 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY

COURSE CODE : MJ

YEAR : FIRST

SUBJECT NAME : PHYSICS FOR MEDICAL IMAGING

SUBJECT CODE : 12739

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	05	03	100	50@	--	--	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Physics for Medical Imaging, is designed for the students to have an understanding of important areas in Physics, knowledge of which are essential in understanding the principles and functioning of equipments and various physical and chemical processes.

Objectives:

On completion of this subject students will be

- Familiar with the principles of medical imaging.
- Better understanding of the imaging equipments and will be able to apply this knowledge in the production of radiographs and the assessment of image quality.
- To understand the construction of the imaging and processing equipment.

Detailed Contents:

Chapter	Contents	Marks	Hours
1	**Radiation Physics:** 1.1 Structure of atom. 1.2 Electromagnetic radiation. 1.3 Production of x-rays. 1.4 Interaction of x-rays with matter. 1.5 Compton process, photoelectric absorption. 1.6 Properties of x-rays. 1.7 Absorbed dose, filtration. 1.8 Effect of scattered radiation, Secondary radiation grid. 1.9 Magnification, distortion, Unsharpened and blurring	10	06
2	**X-rays Tubes:** 2.1 Introduction to X-ray Tubes. 2.2 Types of X-ray Tubes. 2.3 Attenuation of x-rays by the patient.	20	14
3	**Radiography with Films and Grids:** 3.1 Introduction to X-ray film, Types of X-ray Films 3.2 Introduction to X-ray Cassette. 3.3 Introduction to Intensifying screen, Types of intensifying screens, Screen blurring. 3.4 Introduction to Grids, Types of Grids. 3.5 Characteristic curve. 3.6 Radiographic contrast. 3.7 Quantum mottle or noise. 3.8 Choice of exposure factor. 3.9 Introduction to Macro-radiography, Mammography & Xero-radiography.	20	14
4	**Fluoroscopy, Digital Imaging and Computed Tomography:** 4.1 Introduction to Fluoroscopy: Concept, purpose and procedure, applications 4.2 Introduction to Digital imaging: Meaning of the term, Concept, purpose and procedure, applications, Principles of Digital Subtraction Imaging. 4.3 Introduction to Computed tomography: Concept, purpose and procedure, applications	20	12
5	**Gamma Imaging:** 5.1 Radioactivity, radioactive transformation. 5.2 Gamma imaging, characteristics and quality assurance of the gamma imaging. 5.3 Radio-pharmaceuticals, dose to the patient, precaution to be taken in the handling of radio-nuclides, tomography with radio-nuclides.	10	06
6	**Physics of Ultra Sound:** 6.1 Piezoelectric effect, interference: Concept, principle, description & use/applications 6.2 Single transducer probe, behavior of a beam at an interface between different materials. 6.3 Attenuation of ultrasound, A-mode, B-mode. 6.4 Real time imaging, gray scale imaging, resolution, artifacts, M-mode, Doppler methods: Meaning of the terms,	04	03

	use/applications.		
7	**Magnetic Resonance Imaging:** 7.1 Components in MRI operating process, their meaning and importance 7.2 The spinning proton. 7.3 The magnetic resonance signal. 7.4 Spin echo sequence, other pulse sequence, spatial encoding. 7.5 Magnets and coils, quality assurance, and hazards. 7.6 Characteristics of the magnetic resonance image. 7.7 Atomic magnetism.	16	09
	TOTAL	**100**	**64**

List of Practicals:

Students will identify and observe the objects and draw the following diagrams:

1. Cross sectional diagram of X-ray Film.
2. Cross sectional diagram of Intensifying Screen.
3. Characteristic Curve.
4. X-ray Tube.
5. CT scan Tube.

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Dowsett, Kenny, Johston	The Physics of Diagnostic Imaging	1st	1998	Chapman & Hall Medical
Sprawls	Physical Principles of Diagnostic Radiology	--	--	University Park Press
Ball, Moor	Essential Physics for Radiographers	--	--	Blackwell Scientific Wreight
Meredith, Mssey	Fundamental Physics for Radiology	--	--	Wright
Christensen Etal	An Introduction to the Physics of Diagnostic Radiology	--	--	K M Varghese & Co.
Ashuworth	X-ray Physics and Equipment	--	--	Blackwell Scientific Wreight
Johns H F	Physics of Radiology	--	--	Charles Thomas Springfield
Bushong, Stewart C	Radiological Science for Technologist: Physics, Biology and Protection	8th	2004	Mosby, St. Louis
Selman	The Fundamentals of X-ray and radium Physics	6th	--	--
Seeram, Euclid	Computed Tomography: Physical Principles, Clinical Applications, and Quality Control	--	2009	St. Louis, Saunders
M J Brooker	Computed Radiography	--	1986	MTP Press limited,

	for Radiographers			England
Joseph Selman	The Basic Physics of Radiation Therapy	--	--	Charles C Thomas
Beely	Principles of Radiation Therapy	--	--	Butterworth
Mettler, Guibertean	Essentials of Nuclear Medical Imaging	5th	2006	Saunders Elsevier
Schulthess	Clinical Positron Emission Tomography	--	2001	Lippincott Williams & Wilkins
Roger C Sanders	Clinical Sonography, A Practical guide	--	1998	Lippincott
Westbook, Rath	MRI in Practice	3rd	2005	Blackwell Publishing
Stark, Bradley	Magnetic Resonance Imaging	3rd	1999	Mosby
Robert b Lufkin	The MRI Manual	2nd	1998	Mosby
Brooker M J	Computed Tomography for Radiographers	--	1986	MTP Press Ltd, Lancaster
Palmer, PES	Manual of diagnostic Ultrasound	--	2002	World Health Organization, Delhi

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : FIRST
SUBJECT NAME : EQUIPMENT FOR MEDICAL IMAGING - I
SUBJECT CODE : 12740

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	05	03	100	50@	--	--	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Equipment for medical imaging - I, is designed for the students to enable students understand the construction, design, operation of imaging and processing equipments and to familiarize them with the basics and technological aspects of imaging equipments. The students will be introduced to the role of various associated accessories that are used in the imaging. The students will be given hands on experience of handling of various x-ray machines under supervision.

Objectives:

Upon completion of this subject, students will be able to

- Describe the construction and operation of general radiographic equipments.
- Practice the procedures employed in producing a radiographic image.
- Carry out procedures associated with routine maintenance of imaging and processing Equipments.

DETAILED CONTENTS:

Chapter	Contents	Marks	Hours
1	**Introduction to High Tension Generators:** 1.1 The self rectified high tension circuit. 1.2 The valve and solid state half wave, full wave, three phase full wave rectifier circuit, voltage waveforms in high tension generators. Constant potential circuits.	10	06
2	**The X-ray tube:** 2.1 General features of the x-ray tube. 2.2 The fixed anode, rotating anode x-ray tube. 2.3 Rating of x-ray tubes: focal spot sizes. 2.4 Methods of heat dissipation of x-ray tubes. 2.5 Common tube faults. 2.6 Developments in the rotating anode tube. 2.7 Tube stands and ceiling tube supports.	20	15
3	**Components and Control in the X-ray circuits:** 3.1 Description, role in the operation of X-ray machine, representation by block or circuit diagram. 3.2 The high tension transformer. 3.3 Rectification of high tension. 3.4 The control of kilo voltage, kilo voltage indication. 3.5 The filament circuit and control of tube current. 3.6 Exposure timers electronic, automatic. 3.7 Main voltage compensation. 3.8 Mains supply and the X-ray set.	16	10
4	**The Control of Scattered Radiation:** 4.1 Significance of scatter. 4.2 Beam limiting devices-cones, diaphragm (collimators). 4.3 Beam centering devices. 4.4 The secondary radiation grid: its types, components of grid, grid movements. 4.5 The assessment of grid functions.	10	06
5	**Portable and Mobile X-ray Units:** 5.1 Main requirement. 5.2 Portable x-ray machines. 5.3 X-ray equipments for operation theatre.	10	06
6	**Fluoroscopic Equipment:** 6.1 Structure of a fluorescent screen. 6.2 The fluoroscopic image. 6.3 The fluoroscopic table, Spot film devices and explorators. 6.4 Protective measures and physiology of vision.	10	06
7	**Image Intensifiers:** 7.1 Image intensifiers tube, its design, its application. 7.2 The television process and television tube. 7.3 Recording of the intensified image. 7.4 T.V. monitor, video tape recording.	10	06
8	**Tomographic Equipment:** 8.1 Principle of tomography. 8.2 Various types of tomographic movements. 8.3 Multi-section radiography. 8.4 Transverse axial tomography.	06	03

	8.5 Equipment for tomography.		
9	**Equipment for Rapid serial Radiography:** Description and its applications 9.1 The AOT changer. 9.2 The roll film, cut film changer. 9.3 Rapid cassette changer.	04	03
10	**Equipment for Cranial and Dental Radiography:** Description and its applications 10.1 The skull table. 10.2 General dental X-ray equipment. 10.3 Specialized dental X-ray equipment – OPG, Cephalography.	04	03
	TOTAL	**100**	**64**

LIST OF PRACTICALS:

Hands on training to operate the following Equipments under supervision:

Student should prepare a journal which will contain the procedures adopted in operations of the machines.

1. X-ray machines above 200 Ma.
2. X-ray machine with fluoroscopy unit.
3. X-ray machine with Image Intensifier Tube.
4. Portable X-ray machine in wards and ICU.
5. Dental X-ray machine.
6. OPG Machine

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Ashuworth	X-ray Physics and Equipment	--	--	Blackwell Scientific Wreight
D N Chesney, M O Chesney	X-ray equipment for Student Radiographers	3rd	--	CBS Publishers, Delhi

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : FIRST
SUBJECT NAME : RADIOLOGICAL SCIENCE & DARK ROOM TECHNIQUES
SUBJECT CODE : 12741

Teaching and Examination Scheme

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	05	03	100	50@	--	--	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, radiological science & dark room techniques, is designed for the students to be familiar with principles of radiographic imaging, to apply this knowledge to the production of radiograph and the assessment of image quality, to understand the construction, operation of imaging and processing equipment.

Objectives:

On completion of this subject, students should be able to:

- Control and manipulate parameters associated with exposure and processing to produce a required image of desirable quality.
- Practice the procedures employed in producing a radiographic image.
- Carry out quality control for automatic film processing, evaluate and act on results.

DETAILED CONTENTS:

Chapter	Contents	Marks	Hours
1	**The photographic process:** 1.1 Visible Light Images. 1.2 Images Produced by X-radiation. 1.3 Light Sensitive Photographic materials: List of materials with their trade names, 1.4 Photographic Emulsions: List of emulsion materials with their trade names 1.5 The Photographic Latent image, Positive Processes.	08	04
2	**Film materials in x-ray departments :** 2.1 Single & Double coated films. 2.2 Resolving power and graininess of film materials. 2.3 Spectral sensitivity of film materials. 2.4 Speed and contrast of photographic materials. 2.5 Storage of film materials and radiographs	16	04
3	**Sensitometry:** 3.1 Photographic density: Meaning of the term and its measure, density levels for various applications 3.2 Characteristic curves: Their representation and use in operation.	04	02
4	**Intensifying screens and cassettes:** 4.1 Construction of Intensifying screens 4.2 The Fluorescent material. 4.3 The intensification factor. 4.4 The influence of kilo voltage and scattered radiation. 4.5 Detail sharpness and speed. 4.6 Cassette design and care of cassettes. 4.7 Mounting and care of intensifying screens.	16	06
5	**Film processing:** 5.1 Developing, Fixing, Rinsing, Washing and Drying. 5.2 Constitution of Developing and Fixing materials 5.3 The pH scale. 5.4 Manual & Automatic processing. 5.5 Processing area and equipments.	20	06
6	**Radiographic image:** 6.1 Components in image quality. 6.2 The contrast, Un-sharpness and distinctness of the radiographic image. 6.3 Size, shape and spatial relationships.	06	02
7	**Management of the quality of the radiographic image:** 7.1 The benefits of control of the image. 7.2 Management of the image. 7.3 Checks for automatic processors. 7.4 Tests relating to the recording systems. 7.5 Checks relating to the x-ray tube and its output. 7.6 Manipulation of exposure factors.	08	02
8	**The presentation of the radiograph:** 8.1 Opaque letters and legends. 8.2 Perforating devices, actinic markers. 8.3 Identification of dental films.	08	02

	8.4 Preparation of stereo-radiographs. 8.5 Documentary preparation. 8.6 Viewing condition.		
9	**Light images and their recordings:** 9.1 The formation of light images. 9.2 Image formation by a mirror, pinhole & lens. 9.3 Aberrations of lenses. 9.4 Cameras.	08	02
10	**Fluorography and special imaging processes:** 10.1 An optical system for image intensifier fluorography. 10.2 Cameras for fluorography. 10.3 Copying radiographs. 10.4 Subtraction applied to radiography.	06	02
	TOTAL	**100**	**32**

List of Practicals:

1. Loading and unloading of films in the cassette.
2. To check the effect of safe light on exposed as well as unexposed x-ray film.
3. Mounting of Intensifying Screen in the cassette.
4. Regular maintenance of Intensifying Screens.
5. Handling and storage of X-ray Films.
6. Preparation of Developer, Fixer & Replenisher solutions.
7. Manual Processing of X-ray films.
8. Processing of X-ray films in automatic film processor.
9. Copying of radiographs.
10. Printing of Hard copy of Images

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
D N Chesney, M O Chesney	Radiographic Imaging	4th	1987	CBS Publishers, Delhi
Carlton, Adler	Principles of Radiographic Imaging	3rd	2001	Delmar Publishers
Braines H	The Science of Photography	--	--	Halstead Press
Miles, Kenneth	Functional Computed Tomography	--	1997	ISIS Medical oxford Media

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : FIRST
SUBJECT NAME : INTRODUCTION TO ANATOMY
SUBJECT CODE : 12742

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Introduction to Anatomy, is designed for the students to know the surface and radiological human anatomy to correctly position the patient for radiography and Scanning of a particular anatomical area. The combined regional and systemic approach to examine the relationships and organization of the major structures within the thorax, abdomen, head/neck, and back/limbs regions of the body. Students will learn the fundamentals of human anatomy relevant for clinical application. The emphasis of the course is on gross anatomy, with relevant microanatomy taught as needed.

Objectives:

The objectives of this subject is to provide a clear and thorough practical working knowledge of the Anatomy of all the major systems within the human body. This should provide a sufficiently solid grounding for the students.

Detailed Contents:

Chapter	Contents	Marks	Hours
	INTRODUCTION TO HUMAN ANATOMY WITH RESPECT TO:		
1	Brain and spinal Cord	16	06
2	Head & Neck	20	10
3	Thorax, Abdomen, Pelvis and pelvic organs	20	16
4	Skeleton	20	20
5	Skin	04	02
6	Respiratory, Circulatory, Lymphatic, Digestive, Urinary, Reproductive, Endocrine and Nervous System	14	08
7	Organs of Senses & Ductless glands	06	02
	TOTAL	**100**	**64**

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Butler, Paul	Applied Radiological Anatomy	--	1999	Cambridge Univ. Press, Cambridge
Weir, Jamie	Imaging Atlas of Human Anatomy	--	1997	Mosby Year Book, Missouri
A Halim	Surface and Radiological Anatomy		1998	CBS Publishers, Delhi
B D Chaurasia	Human Anatomy	2nd	1989	CBS Publishers, Delhi
Bryan G	Radiographic Anatomy of the Human skeleton	--	--	Blackwell Scientific Wreight
Comuelle, Andrea Gauthier	Radiographic Anatomy and Positioning: An integrated approach	--	1998	Appleton & Stamfort, Lange
Ryan S	Anatomy for Diagnostic Imaging	2nd	2004	Saunders
Weir, Abrahams	An Atlas of Radiological Anatomy	--	--	Pilman Medical
Mekears, Owen	Surface Anatomy for Radiographers	--	--	Blackwell Scientific Wreight
Tortora, Gerard	Principles of Anatomy and Physiology	--	2000	John Wiley & Sons Inc., New York
Ross Wilson	Foundation of Anatomy and Physiology	--	--	Churchill Livingstone

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : FIRST
SUBJECT NAME : INTRODUCTION TO PHYSIOLOGY & PATHOLOGY
SUBJECT CODE : 12743

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Introduction to physiology & pathology, is designed for the students to understand basic human physiology and pathology. A systems approach is used to prepare students to understand relationships among structures that contribute to the functioning of organ systems. A combination of lecture and interactive learning activities will help to develop student knowledge and critical thinking skills as applied to Physiology and Pathalogy terminology and concepts.

Objectives:

The objectives of this subject is to provide a clear and thorough practical working knowledge of the Physiology of all the major systems within the human body, together with an understanding of Pathology. This should provide a sufficiently solid grounding for the students.

Detailed Contents:

Chapter	Contents	Marks	Hours
INTRODUCTION TO HUMAN PHYSIOLOGY WITH RESPECT TO:			
1	Normal Cell, Structure of general tissues.	10	07
2	Composition and function of blood and Lymphatic system.	20	13
3	Digestive System, liver and Spleen.	06	03
4	Urogenital System (Male and Female)	10	07
5	Brain and Spinal Cord	14	10
6	Respiratory System	06	03
7	Hormones	04	03
INTRODUCTION TO HUMAN PATHOLOGY WITH RESPECT TO:			
8	8.1 General pathology of Tumours 8.2 Local and General Effects of Tumours and its Spread.	10	06
9	Diseases and conditions of the Respiratory system.	10	06
10	Diseases and conditions of the Circulatory, Lymphatic, Digestive, Urinary, Reproductive, Endocrine and Nervous system	10	06
	TOTAL	**100**	**64**

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Ross Wilson	Foundation of Anatomy and Physiology	--	--	Churchill Livingstone
Tortora, Gerard	Principles of Anatomy and Physiology	--	2000	John Wiley & Sons Inc., New York
Kowalczck, Nina Mace, James	Radiographic Pathology for Technologists	5th	2009	St. Louis, Mosby
--	--	--	--	--
Butler, Paul	Applied Radiological Anatomy	--	1999	Cambridge Univ. Press, Cambridge
Weir, Jamie	Imaging Atlas of Human Anatomy	--	1997	Mosby Year Book, Missouri
B D Chaurasia	Human Anatomy	2nd	1989	CBS Publishers, Delhi

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : FIRST
SUBJECT NAME : PATIENT CARE IN RADIOGRAPHY
SUBJECT CODE : 12744

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Patient Care in Radiography, is designed for the students to get the knowledge of providing patient care during diagnostic imaging procedures. Development of appropriate communication skills with patients, Radiographers clinical and ethical responsibilities, misconduct, malpractice and handling of pediatric and female patients

Objectives:

On completion of this subject students will develop and demonstrate an increased degree of competence in performance of their duties and skills related to problem solving in the clinical areas. They will continue to utilize the radiologic imaging process as a framework for providing patient care during diagnostic imaging procedures.

Detailed Contents:

Chapter	Contents	Marks	Hours
1	**The Radiographer as a member of the health care system/team:** 1.1 The Health Care Team. 1.2 Ethical and Medico-legal consideration. 1.3 Code of Ethics. 1.4 Self Care. 1.5 Care of supplies and equipment.	10	05
2	**Attitudes and communication in patient care :** 1.1 The Health Illness Continuum. 2.1 Developing professional attitudes. 2.2 Communication with patients & their family members 2.3 Communication with co-workers. 2.4 Pediatric patients. 2.5 Altered states of consciousness. 2.6 The chart as a resource 2.7 Problems-oriented medical recording	10	05
3	**Safety, Transfer and Positioning:** 3.1 Fire prevention In case of fire. 3.2 Other common hazards. 3.3 Body mechanics. 3.4 Patient transfer: Wheel chair transfer, Stretcher transfer. 3.5 Positioning for safety comfort; Safety straps and rails. 3.6 Restraints and immobilization methods. 3.7 Accidents and incident reports	12	06
4	**Infection Control:** 4.1 The cycle of infection, Infectious organisms, the reservoir of infection. 4.2 The susceptible host, Transmission of disease, Practical asepsis. 4.3 Handling linen, Disposal of contaminated waste, Environmental asepsis, surgical asepsis. 4.4 Isolation technique, the isolation patient in radiology dept. 4.5 Precaution for the comprised patient.	08	06
5	**Medication and their administration:** 5.1 The role of the radiographer. 5.2 Medication information, Preparation of injection, Charting. 5.3 The topical route, the oral route, the parenteral route, the intravenous route	04	04
6	**Dealing with acute situations:** 6.1 Accident victims, Head injury, Spinal injury, Extreme ties fracture. 6.2 Wounds, Burns. 6.3 Oxygen administration, Life threatening emergencies. 6.4 Respiratory arrests, Heart attacks and cardiac arrests, Shocks. 6.5 Other medical emergencies - Nausea, Epistaxis, Postural hypotension and vertigo, Seizures, Diabetic coma and insulin reaction, Asthma, Wound dehiscence. 6.6 Multiple emergencies	10	04

7	**Preparation and examination of the gastrointestinal tract:** 7.1 Preparations for examination, Diet, Scheduling sequencing of examination, Ensuring compliance with preparation orders 7.2 Cathartics, Enemas, Contrast media for gastrointestinal examinations, Barium Sulfate, Iodinated media, Air contrast, Barium enemas, Double contrast barium enemas. 7.3 Follow up care	16	10
8	**Use of Contrast media in special imaging techniques:** 8.1 Iodinated contrast media, aqueous iodine compounds for intravascular injection, Reaction to contrast media. 8.2 Contrast examination of the urinary System – IVU, MCU, & RGU. 8.3 Contrast examination of the biliary system - Oral cholecystography, Intravenous cholangiography, PTC, T-Tube. 8.4 Other common contrast examination – Myelography, Contrast arthrography, Bronchography, Angiography, 8.5 Skin preparation. 8.6 Special imaging techniques – CT scan, USG & Mammography.	16	10
9	**Bedside radiography special condition and environments:** 9.1 Mobile radiography. 9.2 Orthopedic traction, orthopedic bed frames. 9.3 The ICU – Tracheostomies, Nasogastric tubes, closed chest drainage, Swan ganz catheters, Pacemaker insertion. 9.4 The neonatal nursery. 9.5 The surgical suite	10	10
10	**Cardio Pulmonary Resuscitation (CPR):** 10.1 Basics of CPR. 10.2 How to give CPR. 10.3 Precaution during CPR	04	04
	TOTAL	**100**	**64**

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
D N Chesney, M O Chesney	Care of the Patient in Diagnostic Radiography	5th	--	CBS Publishers, Delhi
Torror L S	Basic Medical Techniques and Patient care for Radiological Technologists	--	--	J B lippincoll
Godman, Putman	Intensive Care Radiology	2nd	1983	W B Saunders Company
Bhargava S K	Radiological Procedures	1st	2004	Peepee Publishers, Delhi
Clive I Bartram, Praveen Kumar	Clinical Radiology in Gastroenterology	1st	1981	Blackwell Scientific Publication

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : FIRST
SUBJECT NAME : BASIC RADIOGRAPHIC TECHNIQUES - I
SUBJECT CODE : 12745

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	05	03	100	50#	--	50@	200

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Basic radiographic Technique - I, is designed for the students to familiarize them with the applications of plain non-contrast radiography. Student should be able to reliably perform all non-contrast plain Radiography.

Objectives:

On completion of this subject, the student should be able to:

- Correctly Identify the Anatomy to me Imaged.
- To properly position the patient for Imaging
- Correctly select appropriate projection/projections to demonstrate the area of interest
- Use appropriate radiographic parameters to produce a radiograph with satisfactory results
- Differentiate a properly positioned and exposed radiograph from a wrongly positioned and over or underexposed radiograph.
- Correctly identify anatomical features displayed in radiograph obtained.

Detailed Contents:

Chapter	Contents	Marks	Hours
BASIC RADIOGRAPHIC TECHNIQUES WITH RESPECT TO:			
1	**Upper limb:** With special reference to hand wrist joint, and elbow joint, Supplementary techniques for carpal tunnel, scaphoid bone fracture, and head of radius and supra-condylar projections.	20	12
2	**Lower limb:** Which includes all the bones with special reference to ankle joints, knee joint, patella, techniques for calcaneum bone, supplementary techniques for flat foot, intercondylar notch and femur, and metatarsals, etc.	20	12
3	**Shoulder girdle.** With special technique for Clavicle, Shoulder and Scapula.	10	05
4	**Vertebral column:** With special techniques for cervical spine, intervertebral joints and foramina. Lumbo-sacral joint.	20	15
5	**Pelvic girdle and hip region.** With special techniques for Pelvis, Sacrum and SI Joints.	10	05
6	**Respiratory system:** Chest radiography for both the lungs, apical, lordotic and oblique views, techniques to demonstrate fluid levels, effusion in the thoracic cavity, decubitus AP and lateral views.	20	15
	TOTAL	**100**	**64**

List of Practicals:

Hands on training of Positioning and techniques of Imaging Radiographs of the following under supervision:

Student should prepare a journal which will contain the procedures adopted in Imaging Radiographs.

1. Chest.
2. Upper and Lower Extremities.
3. Shoulder girdle.
4. Vertebral column.
5. Pelvic region.

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Frank, long, Smith	Merrill's Atlas of Radiographic Positioning & Procedures	11th	2007	Mosby, Elsevier
Carlton Richard R	Delmar's principles of Radiographic Positioning & procedures pocket guide.	--	1999	Delmar Publishers.
Frank, long, Smith	Merrill's Pocket Guide to Radiography.	6th	2007	Mosby, Elsevier

Clark	Clark's Positioning in Radiology	12th	2005	Hodder Arnold, London.
Stripp W	Special Techniques in Orthopedic Radiology	--	--	Churchill Livingstone
Vander Plaals	Medical X-ray Techniques in Diagnostic Radiology	--	--	Macmillam
Torror L S	Basic Medical Techniques and Patient care for Radiological Technologists	--	--	J B lippincoll
Comuelle, Andrea Gauthier	Radiographic Anatomy and Positioning: An integrated approach	--	1998	Appleton & Stamfort, Lange
Holm T	WHO Basic Radiologic System: Manual of Radiographic Techniques	--	2002	AITBS Publishers, Delhi

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : FIRST
SUBJECT NAME : SEMINAR
SUBJECT CODE : 12746

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	--	--	--	--	50@	--	50

Rationale:

This subject of conducting seminar is intended to equip the students with the necessary basic skills of communications as well as to develop their ability to express the subject knowledge, which they have acquired during the tenure of first year of the programme.

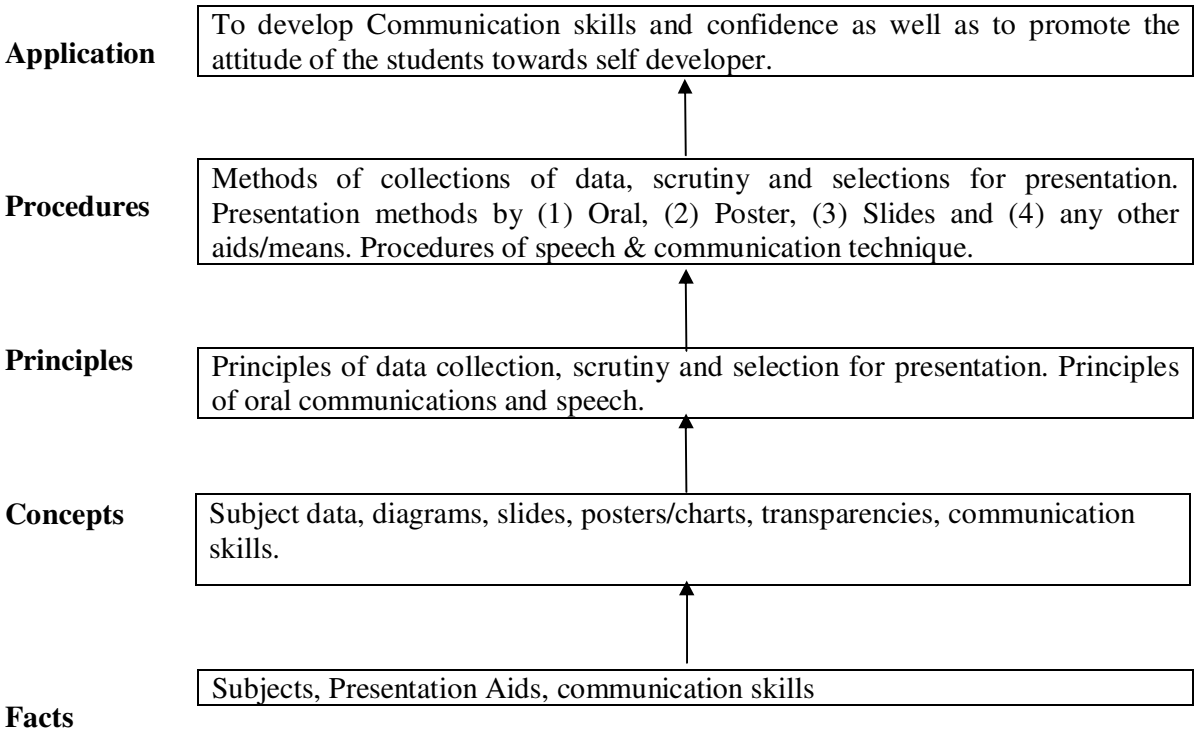
Objectives:

On completion of this subject, students shall be able to develop the confidence amongst the students, which certainly help them in future to build their career as professional and self-developer.

TO BE ASSESED:

5 to 10 Minutes presentation by each student to the class in a rotational basis.

GRAPHICAL STRUCTURE:



IMPLEMENTATIONS STRATGY

The concerned teachers should teach the students the technique of presentation of seminar as well as explain the prose and cones of the same, so that the students will get the correct idea of subject presentation with dignity and decorum, in the presence of group comprises of intellectuals and study class. The teacher may invite the other available experts at the time of delivery of seminar by students, as an observer.

The selection of topics by students may be made from the subjects of first year of the programme with the consent of concerned teacher. Students should collect the necessary data on the selected topics and discuss the same with the teacher before presentation.

The duration for delivering the seminar is 10 minutes for each student. The seminar should be delivered by the students for minimum two times and the marks are to be assigned out of 50 for each attempt (by internal examiner) and thereafter average of the two be taken and to be considered as the oral marks for seminar (out of maximum marks 50).

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : SECOND
SUBJECT NAME : RADIATION PHYSICS & RADIATION PROTECTION
SUBJECT CODE : 12747

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	--	02	50	--	--	--	50

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Radiation physics & Radiation protection, is designed for the students to understand the biological effects of ionizing radiation, radiological safety and radiation protection. Students also learn about the personnel monitoring

Objectives:

On completion of this subject, students shall be able to:

- Apply basic methods of radiation protection in diagnostic radiology.
- Should take all precautions in the protection of staff and patient

Detailed Contents:

Chapter	Contents	Marks	Hours
1	**Biological effects of Radiation:** 1.1 Sources of exposure in environment. 1.2 Somatic & Genetic effects. 1.3 Effects on cellular levels. 1.4 Effects on organs 1.5 Stochastic and non stochastic effects	12	08
2	**Radiation quantities and Units:** 2.1 Activity. 2.2 Exposure. 2.3 Kerma. 2.4 Absorbed Dose. 2.5 Equivalent Dose 2.6 Effective Dose.	14	08
3	**Radiation Protection:** 3.1 Maximum permissible levels for radiation workers and general public. 3.2 ICRP recommendation. 3.3 Principles of time, distance and shielding. 3.4 Half value thickness. 3.5 Personnel Monitoring. 3.6 National/International agencies associated in radiation safety.	24	16
	TOTAL	**50**	**32**

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Walter A Langmead	Radiation protection of the Patient	--	--	British Radiological Protection Association
Bushong, Stewart C	Radiological Science for Technologist, Physics, Biology and Protection	8th	2004	Mosby, St. Louis
Radiological Safety Division, AERB	Safety code for medical diagnostic x-ray equipment and installations	--	1986	Atomic Energy Regulatory Board, Mumbai
Radiological Safety Division, AERB	Transport of Radioactive Materials	--	1986	Atomic Energy Regulatory Board, Mumbai
Radiological Safety Division, AERB	Radiological safety in Enclosed Radiography installations	--	1986	Atomic Energy Regulatory Board, Mumbai
AERB	Protection of the Patient in Diagnostic Radiology	--	--	Atomic Energy Regulatory Board, Mumbai

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : SECOND
SUBJECT NAME : EQUIPMENT FOR MEDICAL IMAGING - II
SUBJECT CODE : 12748

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	05	03	100	50#	--	50@	200

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Equipment for medical imaging - II, is designed for the students to enable students understand the construction, design, operation of imaging equipments including those designed for special procedures and modern Imaging equipments and to familiarize them with the basics and technological aspects of these imaging equipments. The students will be introduced to the role of various associated accessories that are used in the modern imaging equipments. The students will be given hands on experience of handling of various modern imaging equipments under supervision.

Objectives:

Upon completion of this subject, students will be able to

- Describe the construction and operation of full range of radiographic equipments including those designed for special procedures and modern Imaging modalities.
- Practice the procedures employed in producing a modern imaging.
- Carry out routine procedures associated with maintenance of various modern imaging modalities.

DETAILED CONTENTS:

Chapter	Contents	Marks	Hours
1	**Computed Tomography:** 1.1 Historical developments. 1.2 Principle and applications. 1.3 Various generations. 1.4 Definition of terms.	30	20
2	**MRI:** 2.1 Principles and Applications. 2.2 MRI Coils 2.3 Its advantage over computed tomography. 2.4 Its limitations and uses.	30	20
3	**Digital radiography:** 3.1 Principles and Applications. 3.2 Scanned projection radiography. 3.3 Digital subs traction angiography. 3.4 Definition of terms.	20	15
4	**Nuclear Imaging and PET Scan:** 1.1 Its principle, applications and role in medicine. 1.2 Fusion Technology	10	05
5	**Diagnostic ultrasound:** 5.1 Historical developments. 5.2 Its principle, applications and role in medicine. 5.3 Various types of transducers: Their features and applications 5.4 Definition of terms.	10	04
	TOTAL	**100**	**64**

LIST OF PRACTICALS:

Hands on training to operate the following Equipments under supervision:

Student should prepare a journal which will contain the procedures adopted in operations of the machines.

1. Multislice CT scan machine.
2. MRI machine.
3. DSA machine.
4. C-arm machine.
5. Single/ dual arm DSA machine.

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Ashuworth	X-ray Physics and Equipment	--	--	Blackwell Scientific Wreight
D N Chesney, M O Chesney	X-ray equipment for Student Radiographers	3rd	--	CBS Publishers, Delhi
Brooker M J	Computed Tomography for Radiographers	--	1986	MTP Press Ltd, Lancaster
Henwood, Suzanne	Clinical CT: Techniques and Practice	--	1999	Greenwich medical media Ltd, London

Stark, Bradley	Magnetic Resonance Imaging, Vol. 1	3rd	1999	Mosby
Robert b Lufkin	The MRI Manual	2nd	1998	Mosby
Westbook, Rath	MRI in Practice	3rd	2005	Blackwell Publishing
Mettler, Guibertean	Essentials of Nuclear Medical Imaging	5th	2006	Saunders Elsevier
Kessel , Lain Robertson	Interventional Radiology	2nd	2005	Elsevier limited
Roger C Sanders	Clinical Sonography, A Practical guide	--	1998	Lippincott

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : SECOND
SUBJECT NAME : BASIC RADIOGRAPHIC TECHNIQUES - II
SUBJECT CODE : 12749

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	05	03	100	50@	--	--	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Basic radiographic techniques - II, is designed for the student to familiarize them with the applications of all plain non-contrast Radiographs in special situations and also in Wards, ICU, and Operation Theatres.

Objectives:

On completion of this subject, the student should be able to:

- Correctly Identify the Anatomy to me Imaged.
- To properly position the patient for Imaging
- Correctly select appropriate projection/projections to demonstrate the area of interest.
- Use appropriate radiographic parameters to produce a radiograph with satisfactory results.
- Differentiate a properly positioned and exposed radiograph from a wrongly positioned and over or underexposed radiograph.
- Correctly identify anatomical features displayed in radiograph obtained.
- Use Special techniques in Wards, ICU, and Operation Theatres.

DETAILED CONTENTS:

Chapter	Contents	Marks	Hours
BASIC RADIOGRAPHIC TECHNIQUES WITH RESPECT TO:			
1	**Skull:** Radiography of cranial bones, cranium, sella-turcica, orbit optic-foramina, superior orbital fissure and inferior orbital fissure.	25	20
2	**Facial bones:** Para nasal sinuses. Temporal-bone.	15	10
3	**Dental Radiography:** Radiography of teeth-intra oral, extra oral and occlusal view, OPG.	15	05
4	**Macro radiography:** Principal, advantage, technique and applications.	05	02
5	**Stereography:** Procedure - presentation for viewing, stereoscopes, stereometry.	05	02
6	**Soft tissue techniques:** Mammography, Localization of foreign bodies.	12	05
7	**Ward mobile radiography:** Electrical supply, radiation protection equipment and instructions to be followed for portable radiography.	15	14
8	**Operation theatre techniques:** General precautions, Aspects in techniques - Checking of mains supply and functions of equipment, selection of exposure factors explosion risks, radiation protection and rapid processing techniques.	08	06
	TOTAL	**100**	**64**

LIST OF PRACTICALS:

Hands on training of Positioning and techniques of Imaging Radiographs of the following under supervision:

Student should prepare a journal which will contain the procedures adopted in Imaging Radiographs.

1. Skull radiography.
2. Facial bones radiography.
3. OPG and Dental radiography.
4. Portable radiography.
5. Radiography in ICU.
6. Radiography in Casualty / Trauma center.
7. Radiography in operation theatre.

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Frank, long, Smith	Merrill's Atlas of Radiographic Positioning & procedures	11th	2007	Mosby, Elsevier
Carlton Richard R	Delmar's principles of radiographic Positioning & procedures pocket guide.	--	1999	Delmar Publishers.
Frank, long, Smith	Merrill's Pocket Guide to Radiography.	6th	2007	Mosby, Elsevier
Clark	Clark's Positioning in Radiology	12th	2005	Hodder Arnold, London.
Rickard, Wilson, Ferris, Blackett.	Positioning and Quality Control, Mammography Today for Radiographers.	--	1992	Central Sydney Breast X-ray Programme, Sydney
Godman, Putman	Intensive Care Radiology	2nd	1983	W B Saunders Company
Vander Plaals	Medical X-ray Techniques in Diagnostic Radiology	--	--	Macmillam
Dr.(Col) C S Pant	Atlas of Breast Imaging	1st	2002	Jaypee Brothers
Torror L S	Basic Medical Techniques and Patient care for Radiological Technologists	--	--	J B lippincoll
Comuelle, Andrea Gauthier	Radiographic Anatomy and Positioning: An integrated approach	--	1998	Appleton & Stamfort, Lange
Holm T	WHO Basic Radiologic System: Manual of Radiographic Techniques	--	2002	AITBS Publishers, Delhi

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : SECOND
SUBJECT NAME : SPECIAL PROCEDURES IN MEDICAL IMAGING
SUBJECT CODE : 12750

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Special procedures in medical imaging, is designed for the students to get familiarize with the Special procedures pertaining to the body systems. Students will be taught the role of imaging technologist and special projections, as well as, routine projections in the radiological procedures and digital vascular imaging.

Objectives:

On completion of this subject, students shall be able to gain the knowledge about basic and technological aspects of Special procedures.

Detailed Contents:

Chapter	Contents	Marks	Hours
Introduction and Role of Imaging Technologists With Respect To:			
1	**Alimentary tract:** Procedure, requirements, indications, contra indications and contrast media used. Contrast media for swallow, meal and enema. Double Contrast study.	25	16
2	**Urological procedures:** Procedure, requirements, indications, contra indications and contrast media used. IVU, MCU, and RGU techniques	25	15
3	**Radiological procedures Pertaining to:** salivary glands, lacrimal system, Bronchography, arthrography and hystero salpangiography - various requirements trolley set up, indications and contra indications, contract media used.	10	08
4	**Ventriculography and encephalography:** Technique, contrast media used, film sequence, indication and contra indications.	05	02
5	**Myelography:** Technique, contrast media used injection of contrast media indications and contra indications.	05	04
6	**Intra venus cholangiography, T. Tube:** Cholangiographies, preoperative cholangiography, procedure, contrast media, indication and contra indications.	05	04
7	**Interventional Radiological Procedures:** PTC, PTBD, ERCP, fine needle aspiration cytology, percutaneous nephrostomy. Cardiac catherization - embolization, dilation etc. Angiography: Cerebral, cardiac, abdominal aortography, general, renal and selective renal. Splenoporto venography Peripheral, arterial and venous angiography, precautions, radiation protection, film changers, manual automatic biplane, film types - large, miniature, cine contrast media injection procedure and technique	25	15
	TOTAL	**100**	**64**

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Bhargava S K	Radiological Procedures	1st	2004	Peepee Publishers, Delhi
Chapman, Nakienly	A Guide to Radiological Procedures	4th	2001	Jaypee Brothers, Delhi
Laufer, Levine	Double Contrast GI	2nd	--	--

	Radiology			
Frank, long, Smith	Merrill's Atlas of Radiographic Positioning & procedures	11th	2007	Mosby, Elsevier
Carlton Richard R	Delmar's principles of radiographic Positioning & procedures pocket guide.	--	1999	Delmar Publishers.
Clark	Clark's Positioning in Radiology	12th	2005	Hodder Arnold, London.
Clive I Bartram, Praveen Kumar	Clinical Radiology in Gastroenterology	1st	1981	Blackwell Scientific Publication
Kessel , Lain Robertson	Interventional Radiology	2nd	2005	Elsevier limited
Skalpe, Sortland	Myelography	2nd	--	--

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : SECOND
SUBJECT NAME : DIGITAL IMAGING
SUBJECT CODE : 12751

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Digital imaging, is designed for the students to get familiarize with the basics of role of computers in the imaging. Students also learn about the DICOM, RIS, HIS, PACS, Networking and Image processing.

Objectives:

On completion of this subject, students shall be able to gain the knowledge about basic and technological aspects of digital imaging.

Detailed Contents:

Chapter	Contents	Marks	Hours
1	**The basics of:** 1.1 Binary Code. 1.2 The Digital Image. 1.3 The Image file. 1.4 Magnetic domain theory. 1.5 Bandwidth. 1.6 Digital imaging and dose.	12	08
2	**Introduction and knowledge of Equipments:** 2.1 Workstation components. 2.2 Storage media. 2.3 Visual display equipment. 2.4 Acquisition technologies.	08	06
3	**Introduction and knowledge of Interface Standards:** 3.1 General considerations for standards. 3.2 Data components – DICOM, HL7 & IHE.	08	05
4	**Introduction and knowledge of Networking and Interfacing:** 4.1 Networking. 4.2 Interfacing.	08	05
5	**Introduction and knowledge of Radiology Information System:** 5.1 RIS and HIS. 5.2 RIS and PACS. 5.3 RIS and order communications. 5.4 Basic RIS setup.	16	10
6	**Introduction and knowledge of Computed Radiography and PACS:** 6.1 Basic CR setups. 6.2 Network dependency and contingency plans. 6.3 Archiving media considerations.	12	08
7	**Image Processing:** 7.1 Image representation. 7.2 Post Processing of Images 7.3 Compression.	10	06
8	**Image Quality and Quality Assurance:** 8.1 Measuring image quality. 8.2 Quality assurance tests.	08	06
9	**Common Preset Functions and Parameters:** 9.1 Workstation parameters. 9.2 Reporting workstation functions.	10	06
10	**The future of Digital Imaging:** 10.1 Orientation. 10.2 Radiographer as a Computer expert. 10.3 Security issues. 10.4 Reporting from soft copy. 10.5 Copy Images.	08	04
	TOTAL	**100**	**64**

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
M J Brooker	Computed Radiography for Radiographers	--	1986	MTP Press limited, England
Jason Oakley	Digital Imaging	1st	2003	Greenwich Medical Media limited, London
Huang H K	PACS and Imaging Informatics	--	--	--

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : SECOND
SUBJECT NAME : MODERN IMAGING TECHNOLOGY
SUBJECT CODE : 12752

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	05	03	100	50#	--	50@	200

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, Modern imaging technology, is designed for the students to get familiarize with the full range of modern imaging modalities like CT scan, MRI, Mammography, Computed Radiography, PET CT, and Interventional Radiology.

Objectives:

On completion of this subject the students should be able to

- To competently handle the specialized imaging equipments i.e. CT scan, MRI, Mammography and Angiographic equipments and their related accessories.
- Demonstrate good understanding of the normal anatomy and common pathological conditions on the images obtained using these special equipments.
- Should take all precautions in the protection of staff and patient.
- Should have knowledge of the advantages and limitations of the each equipment.

DETAILED CONTENTS:

Chapter	Contents	Marks	Hours
1	**CT Scan:** 1.1 Physical Principles of Computed tomography. 1.2 Data Acquisition Concepts. 1.3 Instrumentation. 1.4 Image Post processing and visulation tools. 1.5 Electron Beam Computed Tomography. 1.6 Multi slice CT. 1.7 Scanning Protocols. 1.8 Patient dose and Quality control. 1.9 CT artifacts. 1.10 Indications and Contra indications.	24	15
2	**MRI:** 2.1 Physical Principles of MRI. 2.2 Equipment description. 2.3 Image formation and SNR. 2.4 Fast imaging. 2.5 Pulse sequences. 2.6 Contrast manipulation. 2.7 Functional MRI. 2.8 Scanning protocols. 2.9 MR artifacts. 2.10 Indications and Contra-indications.	20	15
3	**Mammography:** 3.1 Basic principles of Mammography. 3.2 Equipment description. 3.3 Imaging technology. 3.4 Uses and advantages.	12	05
4	**Computed Radiography:** 4.1 Basic principles of CR. 4.2 Imaging plates. 4.3 Imaging materials. 4.4 Imaging technology. 4.5 CR artifacts. 4.6 Uses and advantages.	12	05
5	**Digital Radiography:** 5.1 Basic principles of DR. 5.2 Imaging Materials. 5.3 Imaging Technology 5.4 Uses and advantages.	06	04
6	**Ultra Sonography :** 6.1 Basic principles of ultra sound. 6.2 Basics of Doppler ultra sound, Doppler flow imaging. 6.3 Types of transducers. 6.4 Uses and advantages	06	04
7	**Interventional Radiology:** 7.1 Basic principles of Interventional radiology. 7.2 Interventional Procedures. 7.3 Imaging materials, imaging technology. 7.4 Uses and advantages.	08	06

8	**Nuclear Medicine and PET CT:** 8.1 Basic principles of Nuclear medicine, Contrast media/imaging material used, Characteristics of radionuclide, commonly used radionuclides, Description of equipments, Imaging technology, Uses and advantages. 8.2 Basic principles of PET CT, Equipment description, Imaging materials used, Imaging technology, Advantages of PET CT	06	05
9	**Portal imaging** Basic principles of portal imaging, Devices, Imaging technology, Advantages and uses.	06	05
	TOTAL	**100**	**64**

LIST OF PRACTICALS:
Hands on training of Imaging of the following under supervision:

1. Imaging techniques of CT scan.
2. Imaging techniques of MRI
3. Imaging techniques in Interventional radiology.
4. Imaging techniques in Mammography.
5. Imaging techniques in CR.
6. Imaging techniques in DR.

Assessments of Knowledge of following Protocols:

1. Protocols for CT scan of Brain.
2. Protocols for CT scan of PNS, Neck & larynx.
3. Protocols for CT scan of Thorax, Abdomen and Pelvis.
4. Protocols for CT Angiography.
5. Protocols for multiphase contrast CT Study.
6. Protocols for multiphase contrast CT Study.
7. Protocols for Dynamic CT Study.
8. Protocols for MRI of Brain.
9. Protocols for MRI of PNS, Neck & larynx.
10. Protocols for MRI of Abdomen and Pelvis.
11. Protocols for MRI of Extremities.
12. Protocols for MR Angiography.
13. Protocols for MRCP.
14. Protocols for Dynamic MRI Study

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Brooker M J	Computed Tomography for Radiographers	--	1986	MTP Press Ltd, Lancaster
Sidhva J N	Cranial Computed Tomography	--	1984	Media Promoters & Pub, Mumbai
Henwood,	Clinical CT: Techniques	--	1999	Greenwich medical

Suzanne	and Practice			media Ltd, London
Miles, Kenneth	Functional Computed Tomography	--	1997	ISIS Medical oxford Media
Whitley, Sloane, Hoadley, Moore, Aslop	Clark's Positioning in Radiology	12th	2005	Hodder Arnold, London.
Westbook, Rath	MRI in Practice	3rd	2005	Blackwell Publishing
Robert b Lufkin	The MRI Manual	2nd	1998	Mosby
Torsten B Moeller, Emil Reif	MRI Parameters and Positioning	--	2003	Thieme
Stark, Bradley	Magnetic Resonance Imaging	3rd	1999	Mosby
M J Brooker	Computed Radiography for Radiographers	--	1986	MTP Press limited, England
Frank, long, Smith	Merrill's Atlas of Radiographic Positioning & procedures	11th	2007	Mosby, Elsevier
Rickard, Wilson, Ferris, Blackett.	Positioning and Quality Control, Mammography Today for Radiographers.	--	1992	Central Sydney Breast X-ray Programme, Sydney
Dr.(Col) C S Pant	Atlas of Breast Imaging	1st	2002	Jaypee Brothers
Schulthess	Clinical Positron Emission Tomography	--	2001	Lippincott Williams & Wilkins
Mettler, Guibertean	Essentials of Nuclear Medical Imaging	5th	2006	Saunders Elsevier
Kessel , Lain Robertson	Interventional Radiology	2nd	2005	Elsevier limited
Roger C Sanders	Clinical Sonography, A Practical guide	--	1998	Lippincott
Palmer, PES	Manual of diagnostic Ultrasound	--	2002	World Health Organization, Delhi

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : SECOND
SUBJECT NAME : PLANNING & QUALITY ASSURANCE IN MEDICAL IMAGING
SUBJECT CODE : 12753

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	05	02	50	50#	--	50@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject, planning & quality assurance in medical imaging, is designed for the students to learn about Quality assurance of the equipments and accessories which is required to maintain the quality of the image and also for the radiation safety of patients and the technologist. Students also learn to prepare simple test tools for QA.

Objectives:

On completion of this subject, students can do the quality assurance tests of the equipment and accessories with the help of simple test tools.

Detailed Contents:

Chapter	Contents	Marks	Hours
1	**Planning of Radio-diagnosis Department**: 1.1 Location of the department. 1.2 Adjacent department and areas. 1.3 Basics of the imaging rooms. 1.4 Patient waiting areas. 1.5 Basics infrastructures of the imaging rooms	06	04
2	**Quality Assurance in Radio diagnosis:** 2.1 Aim of quality assurance in medical imaging. 2.2 Q.A. Programme	06	04
3	**Accessory equipments:** 3.1 Collimator. 3.2 Cassettes and Intensifying screens. 3.3 Grid 3.4 Lead rubber aprons and gloves. 3.5 Viewing box. 3.6 Patient positioning aids. 3.7 Patients measuring calipers.	08	04
4	**X-ray equipments:** 4.1 Choosing x-ray equipments. 4.2 Acceptance of new x-ray equipments. 4.3 Generator. 4.4 X-ray tube, column, table, potter bucky and upright bucky. 4.5 Tomography. 4.6 Portable and mobile x-ray units.	08	04
5	**Manual film processing:** 5.1 The darkroom. 5.2 Film and chemical storage. 5.3 Film processing.	06	04
6	**Automatic film processing:** 6.1 Choosing an automatic processor. 6.2 Use of an automatic processor. 6.3 Processor maintenance schedule. 6.4 Sensitometry.	06	04
7	**Radiographic exposures:** 7.1 Exposure chart. 7.2 The step system	04	02
8	**Making simple test tools:** 8.1 Water phantom 8.2 Aluminium step wedge. 8.3 Film /screen contact test tool. 8.4 Measuring calipers. 8.5 Tomography test tools. 8.6 X-ray beam/grid alignment test tool.	06	06
	TOTAL	**50**	**32**

List of Practicals:

Hands on training of Quality Assurance under supervision:

1. Tests to check light leakage in the cassette.
2. White light leakage test.
3. Safelight efficiency test.
4. Film/screen contact test.
5. Sensitometry test using an aluminium step wedge.
6. Collimator accuracy of scale test.
7. Light beam/x-ray beam alignment test.
8. Film/screen compatibility – colour of light emission test.
9. Grid line damage and grid movement test.
10. Test to detect cracking of lead aprons and gloves.
11. Accuracy of timer and kVp test.
12. Test alignment of x-ray beam to upright bucky.
13. Cassette centered to the middle of the bucky test.
14. Central ray centered to the middle of the bucky test

Reference:

Authors	Title	Edition	Year of Publication	Publisher & Address
Peter J. Lloyd	Quality Assurance Workbook	--	2004	World Health Organization, Geneva
Carroll, Quinn B	Fuch's principles of radiographic Exposures, processing and quality Control	--	--	Charles C Thomas
J A Gannett et al	Assurance of Quality on Diagnostic X-ray Dept. (The Report of BIR diagnostic Methods Committee)	--	--	British Institute of Radiology
Rickard, Wilson, Ferris, Blackett.	Positioning and Quality Control, Mammography Today for Radiographers.	--	1992	Central Sydney Breast X-ray Programme, Sydney
Seeram, Euclid	Computed Tomography: Physical Principles, Clinical Applications, and Quality Control	--	2009	St. Louis, Saunders

COURSE NAME : ADVANCE DIPLOMA IN MEDICAL IMAGING TECHNOLOGY
COURSE CODE : MJ
YEAR : SECOND
SUBJECT NAME : PROJECT
SUBJECT CODE : 12754

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme & Maximum Marks					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	--	--	--	--	--	50@	50

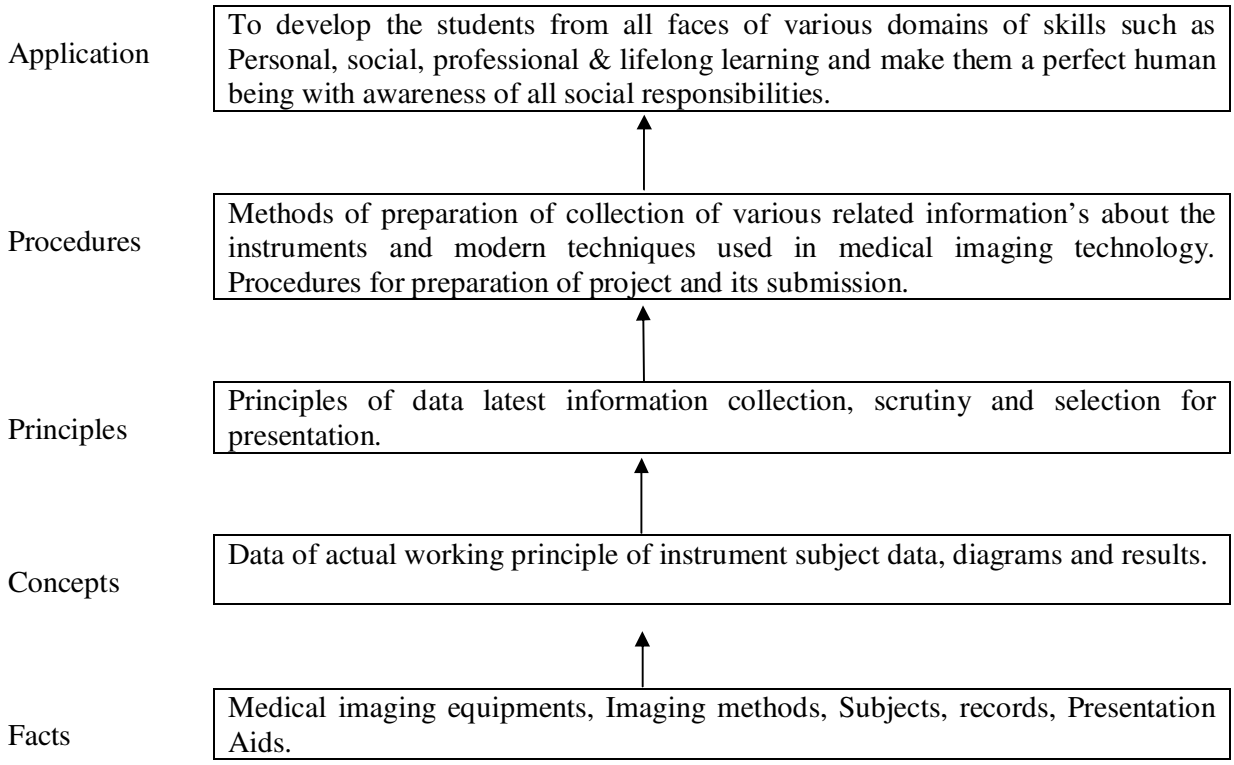
Rationale:

The main aim of the assignment of project is to expose the students to various methods and techniques of medical imaging technology, so that many faceted developments of the students can be achieved under various skills of domains such as personal, social, professional & lifelong learning. The students will be benefited lot by this task of preparation of project which will add values in their attitudes such as value for health, work commitment, hard working, honesty, problem solving, punctuality, loyalty and independent study.

Objectives:

On completion of this subject, students shall be able to develop the personality, communication skills and presentation ideas etc.

GRAPHICAL STRUCTURE:



IMPLEMENTATIONS STRATGY

The topic / subject is to be given by the concerned teachers or it may be selected by the students with prior approval of concerned teachers and the concerned teacher should properly guide the students regarding the entire preparation and subsequent submission of project. It is to compile along with the information about the industry (in which they have been placed) in a bound volume, which is to be submitted as a project report. The concerned teachers are supposed to guide the students for the preparation and presentation of the project report.

The project repost is to be assessed by internal examiners for total of 50 marks.

Imp. Note:-Preparation of project report is to be done by keeping specific views in mind that there **should not be any** sort of typographical, diagrammatic, titles and any other **mistake/s** in the final bound copy to the institute by the candidate.