Republic of the Philippines
OFFICE OF THE PRESIDENT
COMMISSION ON HIGHER EDUCATION

CHED MEMORANDUM ORDER (CMO)
No. 18
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SUBJECT: **POLICIES, STANDARDS AND GUIDELINES FOR RADIOLOGIC TECHNOLOGY EDUCATION**

In accordance with the pertinent provisions of Republic Act (RA) No. 7722, otherwise known as the "Higher Education Act", and for the purpose of rationalizing Radiologic Technology Education in the country with the end in view of keeping at pace with the demands of global competitiveness, the following Policies, Standards, and Guidelines for Radiologic Technology Education are hereby adopted and promulgated by the Commission, thus:

Article 1
INTRODUCTION

Section 1. Technological advancements in Radiology since the discovery of x-rays have been overwhelming with an impressive array of diagnostic and therapeutic equipment presently available. Aside from routine diagnostic radiography, many specialties have emerged such as Nuclear Medicine, Radiation Therapy, Ultrasound, Computed Tomography Scan, Magnetic Resonance Imaging, and Interventional Radiology creating high demand for individuals in this field. A career in Radiologic Technology offers tremendous opportunities for advancement.

Radiologic Technology education played an important role in the development of Radiology to meet the needs of the rapid changes and innovations in this specialty. The practice requires the knowledge necessary for the Radiologic Technologist to perform its tasks with confidence, effectiveness, and efficiency in patient care and management and the operation of specialized equipment in a competent and safe manner.

The Radiologic Technology program requires a full-time, four-year commitment of study. The first three years consists of a didactic component taught at the classroom and the last year is the clinical education component undertaken in the affiliated training hospitals.

Article II
AUTHORITY TO OPERATE

Section 2. All private higher education institutions (PHEIs) intending to offer Bachelor of Science in Radiologic Technology must first secure proper authority from the Commission in accordance with existing rules and regulations. State universities and colleges (SUCs), and local colleges and universities should likewise strictly adhere to the provisions in these policies and standards.

Article III
PROGRAM OF SPECIFICATIONS

Section 3. Graduates of this program shall be conferred the degree Bachelor of Science in Radiologic Technology.

Section 4. The goal of Radiologic Technology Education is to provide the country with dynamic, competent, socially-conscious, and ethical Radiologic Technologists concerned with the application of state-of-the-art scientific techniques in medical imaging and therapy.

Graduates of the program shall have:

- Acquired and developed the knowledge of the various physical principles involved in diagnostic imaging and therapeutic application.
- Developed awareness of the risks involved in the application of various radiant energies (e.g. x-rays) to humans for diagnostic, therapeutic or research purposes and ways of minimizing such risks.
- Developed the skills of proper positioning of patients in the different procedures called for in any particular study employing appropriate exposure factors to achieve desired results.
- Acquired and developed knowledge, attitudes, values, and skills necessary to contribute to the overall social, mental, and physical health of the community and country.
- Responded to the technological advancement in the field of Radiologic Sciences thru research and continuing professional development.

The program is designed to prepare students for employment as radiographers, nuclear medicine technologists or radiation therapy technologists in hospitals, medical offices, cancer centers, community health agencies or industrial concerns where radiation is used for quality control.

Article IV
COMPETENCY STANDARDS

Section 5. Bachelor of Science in Radiologic Technology graduates, like any other Health Professions Education, must be able to apply the cognitive, psychomotor, and affective aspects of the profession in the performance of radiological procedures. Graduates shall:

5.1. provide health care services by applying x-ray energy or with the use of radionuclides to assist in diagnosis or treatment of diseases. Performs radiographic or nuclear medicine procedures and related techniques to produce images for the interpretation by and at the request of a licensed medical practitioner.

5.2. provide radiation therapy services as an essential member of the radiation oncology treatment team and provide total quality care to each patient undergoing a prescribed course of treatment.

5.3. participates in the department's quality assurance and quality control program and assist in maintaining records, thereby respecting confidentiality and established policy.

5.4. exercise professional judgment in the performance of services and maintain a demeanor complementary to medical ethics. Maintain values congruent with the profession's code of ethics and scope of practice and adhere to national, institutional, and/or departmental standards, policies, and procedures in patient care, performance of diagnostic procedures, and treatment delivery.

5.5. pursue continuing education in professional practice and management skills.

Article V
CURRICULUM

Section 6. Higher education institutions offering Radiologic Technology Education may exercise flexibility in their curricular offering. However, Radiologic Technology subjects as prescribed in the sample program of study shall be implemented. The minimum number of academic units required for completion of a degree in Bachelor of Science in Radiologic Technology is 187 units.

Section 7. Curriculum outline.

A. Outline of General Education Courses

Language/Literature/Philosophy	- 21 units
Grammar and Composition I	3
Grammar and Composition II	3
Sining ng Pakikipagtalastasan	3
Pagbasa at Pagsulat	3
Logic	3
Philosopy of Man	3
Philippine Literature in English	3
Mathematics/Natural Sciences/Information Technology	- 22 units
College Algebra	3
Basic Statistics	3
Elements of Research	3
General Zoology	5
College Physics I	5
Fundamental Skills and Word Processing	3
Social Sciences	- 9 units
General Psychology	3
Health Economics with Taxation and Land Reform	3
Sociology and Anthropology with Family Planning	3
Mandated Subjects	- 6 units
Philippine History, Government and Constitution	3
Life and Works of Rizal	3
Physical Education	- 8 units
NSTP-CWTS	- 6 units
B. Major Courses	- 12 units
Human Anatomy and Physiology	5
Community and Public Health	5
Medical Terminology	2
C. Outline of Professional Courses	-103 units
Introduction to Radiologic Technology with STS	3
Radiologic Physics, Equipment and Maintenance I	3
Radiologic Physics, Equipment and Maintenance II	3
Radiographic Technique, Film Processing and Analysis I	3
Radiographic Technique, Film Processing and Analysis II	4
Radiographic Positioning and Radiologic Procedures	7
Radiologic Contrast Examinations	3
Patient Care and Management	3
Department Administration, Ethics, and Jurisprudence	3
Radiobiology and Radiation Protection	3
Phlebotomy	2
Radiologic Pathology	3
Computed Tomography Scan	3

Magnetic Resonance Imaging	3
Interventional Radiology	3
Ultrasonography	3
Radiotherapy	3
Nuclear Medicine	3
Quality Assurance and Quality Control	3
Seminar I	3
Seminar II	3
Clinical Education I	18
Clinical Education II	18

Section 8. Sample program of study.

Bachelor of Science in Radiologic Technology

First Year

First Semester	Lec	Lab	Units
Grammar and Composition I	3	-	3
Sining ng Pakikipagtalastasan	3	-	3
General Psychology	3	-	3
College Algebra	3	-	3
College Physics I	3	2	5
Introduction to Radiologic Technology with STS	3	-	3
P.E. 1			2
NSTP-CWTS 1			3
Total			25

Second Semester	Lec	Lab	Units
Grammar and Composition II	3	-	3
Pagbasa at Pagsulat	3	-	3
Logic	3	-	3
General Zoology	3	2	5
Life and Works of Rizal	3	-	3
Radiologic Physics, Equipment and Maintenance I	2	1	3
P.E. 2			2
NSTP-CWTS 2			3
Total			25

Second Year

First Semester	Lec	Lab	Units
Philippine Literature in English	3	-	3
Fundamental Skills and Word Processing	3	-	3
Human Anatomy and Physiology	3	2	5
Philosophy of Man	3	-	3
Philippine History, Government and Constitution	3	-	3
Radiologic Physics, Equipment and Maintenance II	2	1	3
Radiographic Technique and Film Processing/Analysis I	2	1	3
P.E. 3			2
Total			25

Second Semester	Lec	Lab	Units
Sociology and Anthropology with Family Planning	3	-	3
Health Economics with Taxation and Land Reform	3	-	3
Community and Public Health	3	2	5
Medical Terminology	2	-	2
Radiographic Technique and Film Processing/Analysis II	3	1	4
Patient Care and Management	2	1	3
P.E. 4			2
Total			22

Third Year

First Semester	Lec	Lab	Units
Basic Statistics	3	-	3
Radiographic Positioning and Radiologic Procedures	4	3	7
Radiologic Contrast Examinations	2	1	3
Radiobiology and Radiation Protection	3	-	3
Ultrasonography	3		3
Department Administration, Ethics and Jurisprudence	3	-	3
Venipuncture	2	-	2
Total			24

Second Semester	Lec	Lab	Units
Radiologic Pathology	3	-	3
Computerized Tomography	3		3
Magnetic Resonance Imaging	3		3
Interventional Radiology	3		3
Radiotherapy	3		3
Nuclear Medicine	3		3
Quality Assurance and Quality Control	2	1	3
Elements of Research	3	-	3
Total			24

Fourth Year

First Semester	Units
Clinical Education I 5 1/2 months hospital training (22 weeks--1,056 hours)	18
Seminar I	3
Total -	21

Second Semester	Units
Clinical Education II 5 1/2 months hospital training (22 weeks– 1,056 hours)	18
Seminar II	3
Total -	21

Article VI
COURSE SPECIFICATIONS

Section 9. The following are the course specifications for each of the Radiologic Technology professional courses:

Course Title : **INTRODUCTION TO RADIOLOGIC TECHNOLOGY WITH SCIENCE, TECHNOLOGY AND SOCIETY**

Course Description: Prologue to Radiologic Technology education and practice which will provide an understanding on the scope, outputs, and practices of radiological sciences in general and Radiologic Technology in particular. This course also deals on the interaction of science and technology and their impact to society and environment.

Objective : At the end of the course, student is expected to have a general understanding of radiological sciences, its scope and outputs, practices and limitations relative to Radiologic Technology and enable the student to analyze and explain the interrelationships of science, technology, and society from a historical and futuristic points of view.

Credits : 3 Units – 3 Lecture Hours/Week (54 Hours)
Term : First Year, First Semester
Prerequisites : None

Course Outline:

I. Science and Technology
(18 hours)
1. Nature of science and technology
   1.1. Definition of science and technology
   1.2. Difference of science and technology
   1.3. Significance of science and technology
   1.4. Technological resources
2. Science and technology through the times
3. Constitutional mandate on science and technology in the Philippines
4. Impact of science and technology on
   4.1. Health
   4.2. Health care promotion
   4.3. Environment

II. The Science of Radiology and Radiologic Technology.
(4 Hours)
1. The medical science
2. Radiology: Historical perspective
3. Overview of the application of radiation in medical diagnosis and therapy

III. Radiologic Technology as a Profession.
(14 Hours)
1. Professional practice and scope of educational qualification
2. Job descriptions and limitations
3. The pioneer Radiologists and Radiologic Technologists
4. Establishment of Radiologic Technology schools
5. Formation of groups and associations
6. Creation of Regulatory Board
7. Registration and licensing
8. Continuing professional education
9. Affiliations and linkages.

IV. Radiology as an Imaging Science.
(10 Hours)
1. The concept of radiation
2. The x-ray machine
   2.1. X-ray production
   2.2. X-ray tube component and parts
   2.3. Basic x-ray circuitry
3. Imaging accessories
   3.1. X-ray film and cassettes
   3.2. Intensifying screens
4. Protective measures

V. Other Imaging Modalities
(8 Hours)
1. Ultrasound
2. Computerized Tomography Scan
3. Magnetic Resonance Imaging
4. Nuclear Medicine
5. PET Scan
6. SPECT Scan

References:

Adler, Arlene M., Richard R. Carlton. Introduction to Radiography and Patient Care. 2nd ed. Philadelphia: W. B. Saunders, 1999.

Bushong, Stewart C. Radiologic Science for Technologist: Physics, Biology, and Protection. 7th ed. St. Louis: Mosby, 2001.

Carlton Richard R., Arlene M. Adler. Principles of Radiographic Imaging: An Art and a Science. 3rd ed. New York: Delmar, 2001.

Fosbinder, Robert A., Charles A. Kelsey. Essentials of Radiologic Science. New York: McGraw-Hill, 2002.

Gurley, La Verne Tolley and William J. Callaway. Introduction to Radiologic Technology. 5th ed. St. Louis: Mosby, 2002.

Malott, Jack C., Joseph Fodor. The Art and Science of Medical Radiography. 7th ed. St. Louis: Mosby Year Book, 1993.

McGinn, Robert S. Science, Technology and Society. Singapore: Pearson Education Asia Pte Ltd., 2002.

Course Title : **MEDICAL TERMINOLOGY**

Course Description: Deals with various medical nomenclatures and their usage as applied to specific systems, disease processes, and injuries. Discussions include principal medical root word, terms referring to some general aspects of the practice of medicine and its allied profession, medical terms referring to certain general pathological processes, infective diseases, diseases of various systems of the body, obstetric terms, and terms related to medical instruments and equipment.

Objective : At the end of the course, student is expected to understand terms related to anatomy, physiology, diseases, diagnosis, therapeutic, and instruments in medical application.

Credits : 2 Units – 2 Lecture Hours/Week (36 Hours)
Term : Second Year, Second Semester
Co-requisite : Anatomy and Physiology

Course Outline:

I. Principal Medical Root Word
(5 Hours)
1. Rules of pronunciation
2. Medical words, prefixes, suffixes, and root word.
3. Building medical vocabulary
4. Root words for each system

II. Terms Referring to Some General Aspects of Medicine, Medical Terminology and the Practice of Medicine and its Allied Profession
(3 Hours)
1. Medicine, disease, and medical terminology
2. Causes and classification of disease
3. Manifestations of disease
4. Practice of medicine and allied profession and technical occupation.
5. Diagnosis of disease
6. Treatment of disease
7. Some drugs used in medicine
8. Branches of medicine and surgery

III. Medical Terms Referring to Certain General Pathological Processes
(3 Hours)
1. Manifestations of damage to tissue cells.
2. Infection, antibody formation, inflammation and repair
3. Disorders of growth
4. Disorders in blood circulation
5. Allergy (Hypersensitivity)

IV. Medical Terms Referring to Certain Infective Diseases
(3 Hours)
1. Infectious fevers
2. Pyogenic infection
3. Tuberculosis
4. Venereal disease
5. Some other infective diseases

V. Medical Terms Referring to Diseases of Various Systems of the Body and Obstetric Terms
(15 Hours)
1. The cardiovascular system
2. The respiratory system
3. The digestive system
4. The urinary and male reproductive system
5. The female reproductive system
6. Obstetric conditions
7. The breast
8. The lymphatic and reticuloendothelial systems

9. The blood
10. The endocrine system
11. The teeth
12. The nervous system
13. The eye
14. The ear, nose and throat
15. The mind

VI. Medical Terms Referring to Certain other Types of disease (4 Hours)
1. Connective tissue disease
2. Tropical disease
3. Nutritional disorders
4. Poisoning
5. Disorders due to physical agents
6. Radiation hazards and injury

VII. Medical Instruments and Equipment (3 Lecture Hours)

References:

Applegate, April. The Elements of Medical Terminology. Albany, NY: Delmar Publishers, Inc., 1994.

Davies, Juanita. Essentials of Medical Terminology. Albany, NY: Delmar Publishers, Inc., 1998.

Sormuneu, Carolee. Terminology for Allied Health Professionals. 4th ed. Albany: International Thompson Publishing, 1999.

Indovina, Theresa, Wilburta Q. Lindh. The Radiology Word Book. Philadelphia: F. A. Davis, 1990

Course Title : **RADIOLOGIC PHYSICS, EQUIPMENT AND MAINTENANCE I**

Course Description: An introduction to the basics of electricity, electromagnetism, motors, generators, transformers, and rectifiers. Discussions include mathematical review, units of measure, structure of matter, electrostatics, current, electricity, and magnetism.

Objective : At the end of the course, student is expected to understand the physical principles, nature, properties, various interactions with matter and the application of radiation physics in medicine.

Credits : 3 Units – 2 Units Lecture; 1 Unit Laboratory (36 Hours Lecture ; 54 Hours Laboratory)

Term : First Year, Second Semester

Prerequisite : College Physics I

Course Outline:

I. The Atom
(6 Hours Lec.; 8 Hours Lab.)
1. Atomic Structure
1.1. Nucleus
1.2. Electron
1.3. Atomic weight
1.4. Electron shell/energy level
1.5. Electron binding energy
1.6. Atomic number/AMU
2. Concept of Atom
2.1. Thompson model
2.2. Rutherford model
2.3. Bohr model
3. Basic Forces in Nature
3.1. Nuclear force
3.2. Electromagnetic
3.3. Gravitational

II. Radioactivity
(6 Hours Lec.; 8 Hours Lab.)
1. Radioactive Atom
1.1. Radioactivity
1.2. Physical characteristics of radioactive atom
1.3. Half-life
1.3.1. Physical half-life
1.3.2. Biological half-life
1.3.3. Effective half-life
2. Radioactive Decay Law
2.1. Alpha Decay
2.2. Beta Negative Decay
2.3. Beta Positive Decay
2.4. Gamma Ray Emission
2.5. Electron Capture

III. Electricity and Magnetism
(4 Hours Lec.; 6 Hours Lab.)
1. Electromagnetism
1.1. Nature of magnetism
1.2. Electromagnetic wave
1.3. Properties
2. Quantum Nature of EMW

IV. Radiation
(4 Hours Lec.; 6 Hours Lab.)
1. Basic radiation concept
1.1. General properties

1.2. Types
1.2.1. Particulate
1.2.2. Electromagnetic
2. Inverse square law
3. Quantities and Units
3.1. Non SI Units
3.2. SI Units

V. Interaction of Electron with Matter
(10 Hours Lec.; 14 Hours Lab.)
1. Ionization
2. Excitation
3. Specific Ionization
4. Linear Energy Transfer
5. Electron interaction mechanism
5.1. Characteristic radiation
5.2. Bremmstrahlung radiation

VI. Interaction of Radiation with Matter
(8 Hours Lec.; 12 Hours Lab.)
1. Radiation intensity
2. Attenuation
3. Linear attenuation coefficient
4. Half Value Layer/TVL
5. X-ray interaction mechanism
5.1. Thompson scattering
5.2. Rayliegh scattering
5.3. Compton scattering
5.4. Photoelectric effect
5.6. Pair production
5.7. Photodisintegration

References:

Bushong, Stewart C. Radiologic Science for Technologist: Physics, Biology, and Protection. 7th ed. St. Louis: Mosby, 2001.

Curry, Thomas S., James E. Dowdey. Christensen's Physics of Diagnostic Radiology. 4th ed. Philadelphia: Lea & Febiger, 1990.

Graham, Donald T., Paul Cloke. Principles of Radiological Physics. 4th ed. London: Churchill Livinstone, 2003

Course Title : **RADIOLOGIC PHYSICS, EQUIPMENT AND MAINTENANCE II**

Course Description: Study of the physical principles of radiation, its characteristics, properties, interaction with matter, and application in radiological sciences. This is aimed to familiarize students with the circuitry of an x-ray

unit, x-ray tube, x-ray production, nature of x-rays, inverse square law, half-value layer, as well as to detect defects interfering with the proper function of the equipment and the fundamentals of preventive maintenance.

Objectives : At the end of the course, student is expected to understand the operation of equipment and accessory devices used in radiological examinations and the measures of ensuring good operating conditions of equipment.

Credits : 3 Units – 2 Units Lecture; 1 Unit Laboratory
(36 Hours Lecture ; 54 Hours Laboratory)
Term : Second Year, First Semester
Prerequisites : Radiologic Physics, Equipment and Maintenance I

Course Outline:

I. Basic Circuitry
(5 Hours Lec.; 6 Hours Lab.)
1. Electrification
2. Magnetism
3. Proper grounding system

II. Transformers
(7 Hours Lec.; 10 Hours Lab.)
1. Types of transformers
2. Construction of a transformer
3. Electrical power losses in transformers
    3.1. Copper losses
    3.2. Eddy current
    3.3. Hysteresis losses
4. Capacitors
5. Auto-transformer
6. Electrical symbols

III. X-ray Machine
(16 Hours Lec.; 26 Hours Lab.)
1. Types of x-ray machine according to purpose
2. Filament and tube currents
    2.1. X-ray tube and rectifiers
    2.2. Types of x-ray tubes
    2.3. Effective and apparent focal spot
    2.4. Factors affecting tube life
    2.5. Tube rating charts
3. X-ray circuits
    3.1. Rectification
    3.2. Self-rectification

3.3. Valve-tube rectification
3.4. Single-phase
3.5. Three-phase

4. X-ray control panel
   4.1. Line-voltage compensator
   4.2. Selector knobs and meters

IV. Other Equipment
(5 Hours Lec.; 6 Hours Lab.)

1. Automatic cassette changer
2. Cinefluoro unit
3. Photofluoroscopy unit
4. Dental x-ray unit
5. Xeroradiography unit
6. Bone densitometer
7. Fluoroscopy
8. Mammography unit
9. Conventional tomography unit

V. Automatic Processor
(3 Hours Lec.; 6 Hours Lab.)

1. Film entry system
2. Transport system
3. Replenishment system
4. Water system
5. Dryer system
6. Electrical system
7. Mechanical processing faults, causes, and prevention

References:

Bushong, Stewart C. Radiologic Science for Technologist: Physics, Biology, and Protection. 7th ed. St. Louis: Mosby, 2001.

Carter, Peter. Chesney's Equipment for Student Radiographers. 4th ed. Oxford: Blackwell Scientific Publishers, 1994.

Hendee, William R. The Selection and Performance of Radiologic Equipment. Baltimore: Williams & Wilkens. 1985.

Course Title :**RADIOGRAPHIC TECHNIQUE AND FILM PROCESSING/ANALYSIS I**

Course Description: An understanding of the principles involving action of x-rays on film emulsion and intensifying screens, processing chemicals, the various systems and accessories involved in the conversion of latent image into visible radiographic image following sequential steps in manual and automatic processing, processor operation and maintenance, and learn the skills necessary to critique radiographic images with emphasis in recognizing processing faults with the aid

of radiographs and laboratory exposure experiments. Discussions include processing room design and accessories and regulatory requirements.

Objective : At the end of the course, student is expected to understand the processes involved in the conversion of latent to visible image and evaluate various factors affecting radiographic quality.

Credits : 3 Units – 2 Units Lecture; 1 Units Laboratory
(36 Hours Lecture; 54 Hours Laboratory)
Term : Second Year, First Semester
Prerequisite : Radiologic Physics, Equipment and Maintenance I
Corequisites : Radiologic Physics, Equipment and Maintenance II

Course Outline:

I. Processing Room Design
(2 Hours Lec.; 3 Hours Lab.)
1. Size and location
2. Construction considerations
3. Entrances
4. Lighting and ventilation
5. Drainage system

II. Imaging Accessories
(8 Hours Lec.; 14 Hours Lab.)
1. Radiographic Film
    1.1. Types of films
    1.2. Film construction
    1.3. Handling and storage
2. Film holders
    2.1. Cardboard film holder
    2.2. Cassette with intensifying screen
3. Film hangers and dryers

III. Processing of Latent Image
(14 Hours Lec.; 20 Hours Lab.)
1. System of film processing
    1.1. Manual
    1.2. Automatic
    1.3. Daylight
2. Chemical components
    2.1. Developer
    2.2. Rinsing
    2.3. Fixer

IV. Radiographic Image Quality
(6 Hours Lec.; 7 Hours Lab.)
1. Contrast
2. Density
3. Resolution
4. Mottle
5. Graininess
6. Effect of focal spot

V. Radiographic Film Analysis
(6 Hours Lec.; 10 Hours Lab.)
1. Processing faults
1.1. Causes and remedies
2. Artifacts
2.1. Causes and remedies

References:

Bankman, Isaac N. Handbook of Medical Imaging: Processing and Analysis. California: Academic, 2000.

Bushong, Stewart C. Radiologic Science for Technologist: Physics, Biology, and Protection. 7th ed. St. Louis: Mosby, 2001.

Fauber, Terri L. Radiographic Imaging and Exposure. St. Louis: Mosby, 2000.

Hiss, Stephen S. Understanding Radiography. 3rd ed. Springfield, USA: Charles C Thomas, 1993.

McQuillen-Martensen, Kathy. Radiographic Critique. Philadelphia: W. B. Saunders, 1996.

Sweeney, Richard J. Radiographic Artifacts: Their Cause and Control. Philadelphia: J. B. Lippincott, 1983

Course Title :**RADIOGRAPHIC TECHNIQUE AND FILM PROCESSING/ANALYSIS II**

Course Description: Deals with radiographic imaging and the production of quality radiographs through proper selection, computation, generalization, and application of various technique factors and accessory devices. Discussions include factors affecting radiographic density, contrast, geometric detail, visibility and distortion of detail, and technique conversion factors with the aid of radiographs and laboratory experiments.

Objectives :At the end of the course, student is expected to understand proper selection, computation, and application of different technique factors to produce quality diagnostic radiograph with the least radiation exposure to the patient.

Credits	: 4 Units – 3 Units Lecture; 1 Unit Laboratory (54 Hours Lecture; 54 Hours Laboratory)
Term	: Second Year, Second Semester
Prerequisite	: Radiologic Physics, Equipment and Maintenance I Radiographic Technique and Film Processing/Analysis I
Corequisites	: Radiologic Physics, Equipment and Maintenance II

Course Outline:

I. Technical Factors
(9 Hours Lec., 9 Hours Lab.)
1. Factors governing radiographic contrast
2. Factors governing radiographic density
3. Factors governing geometric detail, visibility and distortion of detail

II. Radiogrpahic Contrast
(15 Hours Lec.; 15 Hours Lab.)
1. Factors affecting contrast
    1.1. kVp
    1.2. mAs
    1.3. Grid
    1.4. Intensifying Screen
    1.5. Beam restrictors
    1.6. Film processing
2. Types of contrast
    2.1. Short and long scale contrast
    2.2. High and low contrast
3. Technique conversion factors
    3.1. The 15% kVp rule
    3.2. kVp and mAs relationship
    3.3. kVp and Exposure Time relationship
    3.4. Technique change when using beam restrictor
    3.5. Correction factor for varying intensifying
    3.6. Grid conversion factor
    3.7. Age correction factor
    3.8. Correction factor for orthopedic radiography

III. Radiographic Density
(15 Hours Lec., 15 Hours Lab.)
1. Factors affecting radiographic density
    1.1. mAs as controlling factor of density
    1.2. Influencing factor for density
        1.2.1. Focal film distance
        1.2.2. kVp
        1.2.3. Pathology
        1.2.4. Film processing
        1.2.5. Intensifying screen

1.2.6. Film emulsion
1.2.7. Heel effect
1.2. mAs-FED relationship
1.3. kVp-mAs relationship
1.4. Mathematical conversion factoring

IV. Geometric Detail, Visibility and Distortion of Detail
(15 Hours Lec.; 15 Hours Lab.)
1. Factors affecting detail and distortion
1.1. Motion
1.2. Focal spot size
1.3. Object-film distance
1.4. Focal-film distance
1.5. Intensifying screen speed
1.6. Non-screen holder
1.7. Film-screen contact
1.8. Target-object-film alignment
2. Types of motion
2.1. Voluntary
2.2. Involuntary
2.3. Limiting motion unsharpness
2.4. Advantages of motion in radiography
3. Effect of focal spot size to radiographic definition
4. Object-film distance
5. Focal-film distance
6. Intensifying screen speed
7. Film-screen contact
7. Tube-object-film alignment

References:

Bushong, Stewart C. Radiologic Science for Technologist: Physics, Biology, and Protection. 7th ed. St. Louis: Mosby, 2001.

Hiss, Stephen S. Understanding Radiography. 3rd ed. Springfield, USA: Charles C Thomas, 1993.

Fauber, Terri L. Radiographic Imaging and Exposure. St. Louis: Mosby, 2000.

Novelline, Robert A. Squire's Fundamentals of Radiology. 5th ed. Cambridge: Harvard University Press, 1997.

Course Title : **RADIOGRAPHIC POSITIONING AND RADIOLOGIC PROCEDURES**

Course Description: Study of the general foundation of positioning technique to obtain radiographic demonstration of anatomical structure of interest as well as specialized radiographic examinations of the different body structures and organs without contrast media. This includes anatomic and radiographic positioning terms,

source-image-receptor distance and tube-film alignment, positioning principles, radiographic landmarks, exposure techniques, structures demonstrated, and evaluation criteria of examinations of the different organs and body structures. Clinical competency is accomplished through positioning demonstration and return demonstration.

Credits : 7 Units – 4 Units Lecture; 3 Units Laboratory
(72 Hours Lecture; 162 Hours Laboratory)

Objectives : At the end of the course, student is expected to demonstrate skills in patient preparation and proper positioning technique for routine and specialized radiographic examinations without contrast media.

Term : Third Year, First Semester
Prerequisite : Anatomy and Physiology
Radiographic Technique and Film Processing/Analysis I
Corequisites : Radiographic Technique and Film Processing/Analysis II

Course Outline:

I. Anatomic and Radiographic Positioning Terminology
(2 Hours Lec.; 6 Hours Lab.)
1. Body planes and positions
2. Divisions of the abdomen
3. Surface landmarks
4. Body habitus
5. Anatomic terms
6. Radiographic positioning terms
6.1. Body part
6.2. Body position
6.3. Projection, position, view and method
6.4. Body movement
7. Source-Image-Receptor distance
8. Tube-Film alignment

II. Upper Limb
(10 Hours Lec.; 14 Hours Lab.)
1. General considerations
1.1. Positioning principles
2. Radiographic landmarks
3. Exposure technique
4. Hand
4.1. PA projection
4.2. PA oblique position
4.3. Lateral position

4.4. Lateral in extension
4.4.1. Ulnar surface to film
4.4.2. Radial surface to film
4.5. AP Oblique Projection (Norgaard Method)
4.6. Lateral in flexion
4.7. First carpometacarpal joint AP axial position
5. Wrist
5.1. PA/AP projection
5.2. Lateral position
5.3. PA/AP oblique positions
5.4. Flexion positions
5.4.1. PA/AP projection
5.4.2. Scaphoid position (Stecher method)
5.5. Tangential position for Carpal Canal (Gaynor-Hart method)
5.6. Tangential position for Carpal Bridge
6. Radius and Ulna
6.1. AP projection
6.2. Lateral position
7. Elbow
7.1. AP projection
7.2. Lateral position
7.3. Medial/Lateral oblique positions
7.4. AP projection for partial flexion
7.5. Acute flexion position
7.6. Lateromedial rotation for radial head
7.7. Axial position for olecranon process and distal humerus
8. Humerus
8.1. AP projection
8.2. Lateral position
8.3. Transthoracic lateral position (Lawrence method)
9. Shoulder
9.1. AP projection
9.1.1. Neutral position
9.1.2. Internal rotation
9.1.3. External rotation
9.2. Transthoracic lateral (Lawrence method)
9.3. Inferosuperior Axial positions
9.3.1. Lawrence method
9.3.2. West Point method
9.3.3. Clements modification
9.4. Axial positions
10. Structures demonstrated
11. Evaluation criteria

III. Lower Limb
(12 Hours Lec.; 20 Hours Lab.)
1. General considerations
1.1. Positioning principles

2. Radiographic landmarks
3. Exposure technique
4. Foot
    4.1. AP (Dorsoplantar) projection
    4.2. Medial/Lateral oblique positions
    4.3. Lateral (Mediolateral/Lateralmedial) positions
    4.4. Calcaneus
        4.4.1. Axial plantodorsal position
        4.4.2. Lateral position
        4.4.3. Oblique position
        4.4.4. Weight-bearing (coalition) position
    4.5. Weight-Bearing position
    4.6. Sesamoids
    4.6. Club foot
5. Ankle
    5.1. AP projection
    5.2. Lateral (Mediolateral/Lateromedial) positions
    5.3. Oblique (medial/lateral) positions
    5.4. AP Stress study
    5.5. Mortise method
    5.6. Subtalar Joints
6. Leg
    6.1. AP projection
    6.2. Lateral position
    6.3. Oblique position
7. Knee, Patella, and Intercondylar Fossa
    7.1. AP/PA projection
    7.2. Lateral position
    7.3. Weight-bearing (AP/PA) projections
    7.4. AP/PA oblique position
    7.5. Tangential positions for Patella
    7.6. Axial positions for Intercondyloid Fossa
8. Femur
    8.1. AP projection
    8.2. Lateral position
    8.3. Femoral necks
        8.3.1. AP axial position (Cleaves method)
9. Hip joint
    9.1. AP projection
    9.2. Lateral position (Lauenstein & Hickey method)
    9.3. Axiolateral position
    9.4. RAO/LAO positions
10. Acetabulum
    10.1. RAO/Lateral position
    10.2. Teufel method
    10.3. Judet approach
    10.4. Superoinferior oblique position
11. Structures demonstrated
12. Evaluation criteria

IV. Skull (Cranium)
(20 Hours Lec.; 36 Hours Lab.)
1. General considerations
    1.1. Positioning Principles
    1.2. Indications and Contraindications
2. General body positions
3. Exposure technique
4. Radiographic examinations
    4.1. Cranium projections
    4.2. Sella Turcica
    4.3. Orbit
    4.4. Optic Foramen
    4.5. Eye (Localization of foreign bodies within the orbits)
    4.6. Facial Bones
    4.7. Zygomatic Arches
    4.8. Mandible
    4.9. Temporo-mandibular Joint
    4.10. Paranasal Sinuses
    4.11. Mastoids
    4.12. Internal Auditory Canal
    4.13. Petromastoid portion
5. Structures demonstrated
6. Evaluation criteria

V. Vertebral Column
(6 Hours Lec.; 14 Hours Lab.)
1. General considerations
    1.1. Positioning principles
    1.2. Indications and Contraindications
2. Breathing instruction
3. Exposure technique
4. Cervical vertebrae
    4.1. AP projection
    4.2. Lateral position
    4.3. Axial positions
        4.3.1. RPO/LPO (AP oblique) positions
        4.3.2. RAO/LAO (PA oblique) positions
    4.4. AP (Open-mouth) projection for Odontoid process
    4.5. Ottonello method
    4.6. Grandy method
    4.7. Fuchs method
    4.8. Judd method
    4.9. Kasabach method
    4.10.Adaptation of Position for Severely Injured Patients
    4.11. Lateral Cervico-Thoracic region
        4.11.1. Twining method
        4.11.2. Pawlow method
5. Thoracic Vertebrae
    5.1. AP projection

5.2. Lateral position
5.3. Oblique positions
5.4. Localized lateral position
5.5. Scoliosis series

6. Lumbar/Lumbosacral Vertebrae
   6.1. AP/PA projection
   6.2. Lateral position
   6.3. Oblique positions
      6.3.1. RAO/LAO (PA oblique) positions
      6.3.2. RPO/LPO (AP oblique) positions
   6.4. Localized lateral position
   6.5. Bending positions
7. Sacrum and Coccyx
   7.1. AP/PA projection
   7.2. Lateral position
   7.3. Axial position
8. Sacro-iliac joint
   8.1. Oblique positions
      8.1.1. RPO/LPO (AP oblique)
      8.1.2. RAO/LAO (PA oblique) positions
   8.2. Chamberlain method of demonstrating
9. Structures demonstrated
10. Evaluation criteria

VI. Bony Thorax,
(4 Hours Lec.; 12 Hours Lab.)

1. General considerations
   1.1. Positioning principles
2. Exposure technique
3. Breathing instruction
4. Sternum
   4.1. RAO position
   4.2. Lateral position
5. Ribs
   5.1. AP/PA projection
   5.2. Oblique positions
      5.2.1. RAO/LAO (PA oblique) positions
      5.2.2. RPO/LPO (AP oblique) positions
6. Clavicles
   6.1. PA projection
   6.2. AP/PA axial projection
   6.3. Tangential position
7. Scapula
   7.1. AP projection
   7.2. Lateral position
   7.3. AP/PA oblique position
8. Structures demonstrated
9. Evaluation criteria

VII. Chest for Lungs and Heart
(6 Hours Lec.; 16 Hours Lab.)
1. General considerations
    1.1. Positioning
2. Exposure technique
3. Breathing instruction
4. Projections
    4.1. PA/AP projection
    4.2. Right/Left lateral position
    4.3. Oblique positions
    4.4. Lordotic position
    4.5. Decubitus position
5. Structures demonstrated
6. Evaluation criteria

VIII. Abdomen and Pelvis
(4 Hours Lec.; 12 Hours Lab.)
1. General considerations
    1.1. Positioning principles
2. Patient preparation
3. Exposure technique
4. Abdomen
    4.1. AP/PA projection
    4.2. Lateral position
    4.3. Decubitus position
5. Pelvis
    5.1. AP projection
6. Structures demonstrated
7. Evaluation criteria

IX. Prenatal Radiography
(2 Hours Lec.; 8 Hours Lab.)
1. General considerations
    1.1. Positioning principles
    1.2. Indications and Contraindications
2. Patient preparation
3. Exposure technique
4. Radiographic examinations
    4.1. Placentography
    4.2. Fetography
    4.3. Cephalometry
    4.4. Pelvimetry
5. Structures demonstrated
6. Evaluation criteria

X. Pediatric Radiography
(2 Hours Lec.; 8 Hours Lab.)
1. General considerations
    1.1. Positioning principles

1.2. Indications and contraindications
2. Patient preparation
3. Exposure technique
4. Radiographic examinations
    4.1. Abdomen
        4.1.1. Anorectal malformation
    4.2. Bone age
5. Structures demonstrated
6. Evaluation criteria

XI. Bedside and Operating Room Radiography
(3 Hours Lec.; 8 Hours Lab.)
1. Mobile radiography
2. Orthopedic traction cases
3. Special care units
4. Surgical examinations
    4.1. Access and clothing
    4.2. Surgical set-up
    4.3. Surgical environment
    4.4. Radiological examinations
        4.4.1. Operative cholangiogram
        4.4.2. Reductions & internal fixations

XII. Mammography
(3 Hours Lec.; 8 Hours Lab.)
1. General considerations
    1.1. Positioning principles
    1.2. Indications and contraindications
2. Patient preparation
3. Technical factors
    3.1. x-ray equipment
    3.2. Scattered radiation
    3.3. Screen-film system
    3.4. Film processing
    3.5. Viewing conditions
4. Examination technique
    4.1. Anatomy and physiology of the breast
    4.2. Risk versus benefit
    4.3. Positioning/method of examination
    4.4. Compression
    4.5. Number of projections
    5.6. Breast specimen radiography
5. Patient factors
    5.1. Ratio fat/fibroglandular tissue
    5.2. Morphology of carcinoma
6. Aspects on the differential diagnosis of breast diseases
    6.1. Tumor (mass, density)
    6.2. Calcification
    6.3. Retraction (distortion)

6.4. Edema

References:

Ballinger, Philip W., Eugene D. Frank. Meril's Atlas of Radiographic Positions and Radiologic Procedures. 9th ed. St. Louis: Mosby, 1999.

Bontrager, Kenneth L., John P. Lampignano. Textbook of Radiographic Positioning and Related Anatomy: Workbook and Laboratory Manual. 5th ed. St. Louis: Mosby, 2001.

Long, Bruce W., John A. Rafert. Orthopaedic Radiography. Philadelphia: W. B. Saunders, 1995.

Williams, Erica Koch, Jennifer Wagner. Procedures and Documentation for Mammography and Quality Management. New York: McGraw-Hill, 2000.

Course Title : **RADIOLOGIC CONTRAST EXAMINATIONS**

Course Description: Study of specialized radiographic examinations with application of contrast media to enhance and/or visualize different organs and body structures of interest. This includes types of contrast media, its characteristics and properties, indications and contraindications, and mode of administration; patient preparation and types of examinations of the gastrointestinal tract, genitourinary system, central nervous system, vascular system, and other contrast examinations.

Objectives : At the end of the course, student is expected to demonstrate skills in preparing and positioning patients for special radiographic examination and administration of contrast media.

Credits : 3 Units – 2 Units Lecture; 1 Unit Laboratory
(54 Hours Lecture; 54 Hours Laboratory)

Term : Third Year, First Semester

Prerequisites : Anatomy and Physiology

Corequisite : Radiographic Positioning and Radiologic Procedures

Course Outline:

I. Contrast Media
(6 Hours Lec., 8 Hours Lab.)
1. Types of contrast media
2. Characteristics and properties
3. Indications and contraindications
4. Mode of administration

II. Special Radiographic Examinations
(30 Hours Lec.; 46 Hours Lab.)
1. Gastro-Intestinal Tract
1.1. Indications and contraindications
1.2. Preparation of patient
1.3. Contrast medium
1.4. Types of examination
1.4.1. Sialography
1.4.2. Pharyngography
1.4.3. Esophagography/Barium Swallow
1.4.4. UGIS/Barium Meal
1.4.5. Small Intestinal Series
1.4.6. Barium Enema
1.4.7. Biliary system
1.4.7.1. Cholecystography and cholangiography
1.4.7.2. Operative cholangiography
1.4.7.3. T-Tube cholangiography
1.4.7.4. Percutaneous Transhepatic Cholangiography
1.4.7.5. Endoscopic retrograde cholangio-pancreatography
1.5. Modifications of positioning
2. Genito-Urinary Sytem
2.1. Indications and contraindications
2.2. Preparation of patient
2.3. Contrast medium
2.4. Types of examination
2.4.1. Intravenous urography
2.4.2. Infusion IVU
2.4.3. Contrast medium
2.4.4. Types of examination
2.4.5. Cystourethrogram
2.4.6. Micturation Cystourethrogram
2.5. Modifications of positioning
3. Reproductive System
3.1. Indications and contraindications
3.2. Preparation of patient
3.3. Contrast medium
3.4. Types of examination
3.4.1. Epididymography/Vesiculography
3.4.2. Prostatography
3.4.3. Hysterosalpingography
3.4.4. Vaginography
4. Respiratory System
4.1. Indications and contraindications
4.2. Preparation of patient
4.3. Contrast medium
4.4. Type of examination
4.4.1. Bronchography

4.5. Modifications of positioning

5. Central Nervous System
   - 5.1. Indications and contraindications
   - 5.2. Preparation of patient
   - 5.3. Contrast medium
   - 5.4. Types of examination
     - 5.4.1. Ventriculography/Pneumonography
     - 5.4.2. Pneumoencephalography
     - 5.4.3. Myelography
     - 5.4.4. Diskography
     - 5.4.5. Radiculography
   - 5.5. Modifications of positioning
6. Vascular System
   - 6.1. Indications and contraindications
   - 6.2. Preparation of patient
   - 6.3. Contrast medium
   - 6.4. Types of examination
     - 6.4.1. Angiography
     - 6.4.2. Aortography
     - 6.4.3. Cardiac catheterization
     - 6.4.4. Cerebral arteriography
     - 6.4.5. Angio-cardiography
     - 6.4.6. Venography
     - 6.4.7. Spleno-Portography
     - 6.4.8. Renal arteriography
     - 6.4.9. Percutaneous Spleenography
   - 6.5. Modifications of positioning
7. Other contrast examinations
   - 7.1. Dacryocystography
   - 7.2. Nasopharyngography
   - 7.3. Laryngography
   - 7.4. Sinus tract visualization
   - 7.5. Fistulogram

References:

Ballinger, Philip W., Eugene D. Frank. Meril's Atlas of Radiographic Positions and Radiologic Procedures. 9th ed. St. Louis: Mosby, 1999.

Bontrager, Kenneth L., John P. Lampignano. Textbook of Radiographic Positioning and Related Anatomy: Workbook and Laboratory Manual. 5th ed. St. Louis: Mosby, 2001.

Tortorici, Marianne. Administration of Imaging Pharmaceuticals. Philadelphia: W. B. Saunders, 1996.

Course Title : **VENIPUNCTURE**

Course Description: To provide the students an opportunity to develop a fundamental concept of the skills needed to competently, proficiently, safely perform intravenous contrast media administration.

Course Objectives: At the end of the course, student is expected to discuss legal and ethical aspects of contrast media administration, identify appropriate venous anatomy and relate correct circulatory physiology, demonstrate acceptable universal precaution techniques, define and apply pertinent radiographic pharmacology, perform pertinent patient assessments, correctly prepare and administer IV contrast media, perform safe and accurate venipuncture procedures, and recognize and participate in the care of patients with adverse reactions to IV contrast media.

Credits : 2 Units – 2 Lecture Hours/Week (36 Hours)
Term : Third Year, First Semester
Prerequisite : Human Anatomy and Physiology
Corequisites : Radiologic Contrast Examinations

Course Outline:

I. Legal Aspect of IV Contrast Media and Medication Administration (2 Hours)
   1. Laws and regulations
   2. Institutional policy and procedure
      2.1. Informed consent
   3. Responsibility and accountability
   4. Documentation

II. Peripheral Circulation Anatomy and Physiology (4 Hours)
   1. Anatomy
      1.1. Arteries
      1.2. Veins
      1.3. Nerve fibers
   2. Circulation
      2.1. Systemic (arterial/venous)
   3. Site Selection
      3.1. Common vein sites
      3.2. Location of best insertion site
      3.3. Reason for infusion
      3.4. Length of time patient is to receive IV therapy
      3.5. Patient factor

III. Universal Precaution
(4 Hours)
1. Infection control terminology
   1.1. Nosocomial
   1.2. Communicable
   1.3. Infectious pathogens
2. Cycle of infection
   2.1. Infectious pathogens
   2.2. Reservoir of infection
   2.3. Susceptible host
   2.4. Transmission of diseases
3. Preventing disease transmission
   3.1. Body substance precaution
4. Asepsis
   4.1. Sterile versus clean
5. Practical precautions
   5.1. Proper handwashing techniques
   5.2. Gloving techniques
   5.3. Sterile and aseptic technique

IV. Contrast Media and Pertinent Radiographic Pharmacology
(6 Hours)
1. Contrast media
   1.1. Ionic
   1.2. Non-ionic
2. Concepts of pharmacokinetics
   2.1. Mechanism of drug actions
   2.2. Indications/contraindications
   2.3. Dosage and calculations
   2.4. Administration
   2.5. Side effects
   2.6. Complications
   2.7. Compatibility
   2.8. Special consideration
      2.8.1.1. Medical history
      2.8.1.2. Allergies
      2.8.1.3. Age
      2.8.1.4. Sex
      2.8.1.5. Other medications
3. Intravenous fluids for IV access and maintenance
   3.1. Dextrose in water solutions
   3.2. Dextrose in saline solutions
   3.3. Saline solutions
   3.4. Electrolyte solutions

V. Patient Assessment
(4 Hours)
1. Organizing proper patient assessment procedure
2. Establishing rapport with patient

3. Evaluation of patient history
4. Observing signs and documenting symptoms
5. Monitoring and recording of vital signs
6. Documenting patient assessment (pre/during venipuncture)
7. Performing discharge assessment

VI. Preparation and Administration of Contrast Media and Intravenous Solutions
(4 Hours)
1. Direct IV push
2. Drip Infusion
3. Intravenous Piggyback therapy for contrast media
4. Intermittent venous access devices
5. Administration of contrast media and medication

VII. Venipuncture Techniques
(8 Hours)
1. Patient education and preparation
2. Venipuncture devices
3. Venipuncture procedure
4. Discontinue an intravenous access device

VIII. Adverse Reaction to IV Contrast Media and Medication
(4 Hours)

Reference:

ANSAP Nursing Standards on Intravenous Practice. 6th ed.
Josephson, Dianne L. Intravenous Infusion Therapy for Nurses: Principle and Practice. USA: Delmar Learning, 2004.
Estes, Mary Ellen Zator. Health Assessment and Physical Examination. USA: Delmar Learning, 2002.
Kee, Joyce LeFever, Evelyn R. Hayes. Pharmacology, A Nursing Process Approach. 4th ed. Philippines: Elsevier Science, 2005.
Baer, Charold L., Bradley R. Williams. Clinical Pharmacology and Nursing. 3rd ed. Pennsylvania: Springhouse Corporation, 1996.

Course Title : **PATIENT CARE AND MANAGEMENT**

Course Description: Study of the elements of patient care and management as they relate to radiography.

Objectives: : At the end of the course, student is expected to demonstrate the skills in patient identification and observation, transfer, control of infection, observation of vital signs, and identification and management of emergence situations.

Credits : 3 Units – 2 Units Lecture; 1 Unit Laboratory
(36 Hours Lecture; 54 Hours Laboratory)
Term : Third Year, First Semester
Prerequisite : Anatomy and Physiology
Corequisites : Medical Terminology

Course Outline:

I. Patient Care and Management
(3 Hours Lec.; 8 Hours Lab.)
1. Patient's identification
2. Patient's communication
2.1. Communication defined
2.2. Becoming a successful communicator
2.3. Nonverbal communication
2.4. Feedback
3. Developing a harmonious working relationship
4. Legal responsibilities

II. Admission of Patient for Radiological Examination
(6 Hours Lec.; 10 Hours Lab.)
1. Consent required
2. Physician's order
3. Correlation of patient observation with ordered radiographic procedure
4. Suggestions for modified/additional procedures
5. Care of patient valuables
6. Dressing/undressing patient
7. Assisting patient with use of bedpan/urinal

III. Body Mechanics, Patient Transfer and Skin Care
(8 Hours Lec.; 10 Hours Lab.)
1. Body mechanics
1.1. Gravity
1.2. Body alignment
1.3. Body balance
2. Principles of body mechanics
3. Moving and transferring patient
3.1. Assessment of patient's ability
3.2. Rules when moving a patient
4. Methods of transfer
4.1. Gurney
4.2. Wheelchair
4.3. Ambulation
5. Positioning on radiographic table
6. Special conditions
6.1. Partial or total paralysis
6.2. Head/spinal cord injury

6.3. Cardiac conditions
6.4. Attached medical equipment
6.5. Attached chest, stomach or intestinal tubes
7. Skin care
7.1. Decubitus ulcer
7.2. Casts

IV. Medical Asepsis
(3 Hours Lec.; 4 Hours Lab.)
1. Methods of maintaining medical asepsis
1.1. Handwashing
1.2. Cleaning and proper waste disposal
1.3. Disinfection
1.4. Sterilization
1.5. Aseptic versus sterile techniques

V. Vital Signs and Patient Assessment
(8 Hours Lec.; 12 Hours Lab.)
1. Temperature
1.1. Instrument
1.2. Monitoring
1.2.1. Oral
1.2.2. Axillary
1.2.3. Rectal
1.3. Normal Values
2. Pulse
2.1. Instrument
2.2. Location
2.3. Monitoring
2.4. Normal Values
3. Respiration monitoring
4. Blood pressure
4.1. Instrument
4.2. Location
4.3 . Monitoring
4.4. Normal Values
5. Procedure for Patient Assessment
5.1. Mental status
5.2. Monitoring respiration
5.3. Skin color
5.4. Bleeding
5.5. Sensory evaluation and pain
5.6. Musculoskeletal integrity
5.7. Patient mobility

VI. Medical Emergencies in the Radiology Department
(8 Hours Lec.; 10 Hours Lab.)
1. The technologist's role
2. Dealing with acute situations

3. Life-threatening emergencies
4. Aids for medical emergencies
5. Emergency medication and administration

Reference:

Adler, Arlene M., Richard R. Carlton. Introduction to Radiography and Patient Care. 2nd ed. Philadelphia: W. B. Saunders, 1999.

Drafke, Michael W., Harry Nakayama. Trauma and Mobile Radiography. 2nd ed. Philadelphia: F. A. Davis Company, 2001

Ehrlich, Ruth Ann, Ellen Doble McCloskey. Patient Care in Radiography: With an Introduction to Medical Imaging. 5th ed. St. Louis: C. V. Mosby, 1999.

Course Title : **DEPARTMENT ADMINISTRATION, ETHICS, AND JURISPRUDENCE**

Course Description: Deals with the organization, function, supervision, and budgetary outlay of a radiological facility and the accepted ethical principles and legal aspect of the profession. Discussions include management and human resource administration, elements of hospital administration, administration of a radiological facility, supervision, laws and regulations governing the practice of radiologic technology, professional ethics, relevant medical jurisprudence, and other legal and ethical concerns.

Objectives : At the end of the course, student is expected to understand the principles of hospital organization, management, and supervision relative to the operation of a radiological facility as well as ethical and legal responsibilities as a member of a health related profession.

Credits : 3 Units – 3 Lecture Hours/Week (54 Hours Lecture)
Term : Third Year, First Semester
Prerequisites : Introduction to Radiologic Technology

Course Outline:

I. Management and Human Resource Administration (4 Hours)
   1. Theories and models of organizational behavior
   2. The individual in the organization
   3. Human relations and the individual
   4. Concepts of management and leadership

5. Organizational chart and lines of authority

II. Hospital Administration
(4 Hours)
1. Hospital objectives
2. Types of hospitals
3. Staffing
4. Management and operation
5. Liabilities of hospitals

III. Elements of Hospital Administration
(6 Hours)
1. Planning
2. Organizing
3. Implementing
4. Coordinating
5. Evaluating

IV. Administration of a Radiological Facility
(6 Hours)
1. Function
2. Location
3. Designing team
4 Governmental requirements
5. Staffing
6. Management and operation
7. Department policies
8. Departmental/Interdepartmental relationship
9. Financial consideration

V. Supervision
(10 Hours)
1. Levels of supervision
2. Duties and responsibilities of a supervisor
3. Supervisor's span of control
4. The art of leadership and leadership styles
5. Converting policy into action
6. Planning work schedule
7. Time study fundamentals
8. Improving work methods
9. Figuring and controlling cost
10. Maintaining equipment and facilities

VI. Professional Ethics
(8 Hours)
1. Nature of Ethics
2. Ethical values
3. Code of Ethics for Radiologic Technologists
4. Professionalism and etiquette

VII. Jurisprudence
(12 Hours)
1. Legal nomenclatures relevant to medical practice
2. The practice of medicine
    2.1. Physician-Patient relationship
    2.2. Rights of patients
    2.3. Legal doctrines applied to medical malpractice
    2.4. Damages
    2.5. Attendance of medical witness in court
        2.5.1. Subpoena
        2.5.2. Court procedure
3. Radiologic Technology Law
    3.1. Examination, Licensing and Registration requirements
    3.2. Oath of professionals
    3.3. Relevant Professional Regulation Commission regulations and guidelines on continuing professional development

VIII. Miscellaneous Legal and Ethical Concerns
(4 Hours)
1. Request for radiological examination
2. Patient's consent
3. Loan of film
4. Ownership and care of equipment
5. Applying new techniques
6. Visitors in the Radiology Department
7. Other laws related to allied medical practice

References:

Campeau, Frances E. Radiography: Technology, Environment, Professionalism. Philadelphia: Lippincott Williams & Wilkens, 1999.

Hiss, Stephen S. Introduction to Health Care Delivery and Radiology Administration. Philadelphia: W. B. Saunders, 1997.

Obergfell, Ann M. Law and Ethics in Diagnostic Imaging and Therapeutic Radiology with Risk Management and Safety Applications. Philadelphia: W. B. Saunders, 1995.

Solis, P. Medical Jurisprudence. Quezon City: Garcia Publishing Co., 1988.

Towsley-Cook, Doreen M. Ethical and Legal Issues for Imaging Professionals. St. Louis: Mosby, 1999.

Primer on Radiologic Technology

Course Title : **RADIOBIOLOGY AND RADIATION PROTECTION**

Course Description: Study of the effects of ionizing radiation on biological matters, the principles of radiation protection as well as agencies and institutions mandated to regulate and monitor the safe use of radiation and radioisotope in medicine.

Objectives : At the end of the course, student is expected to understand the basic concept of radiation interaction as it relates to radiation biology and protection.

Credits : 3 Units – 3 Lecture Hours/Week (54 Hours Lecture)
Term : Third Year, First Semester
Prerequisites : Anatomy and Physiology
Radiologic Physics, Equipment and Maintenance
Radiographic Technique & Film Processing/Analysis II

Course Outline:

I. Review of Basic Radiation Concepts
(6 Hours)
1. Classification of radiation
2. Sources of human exposure to radiation
3. Mode of human exposure to radiation
4. Classification of human exposure to radiation
5. Radiation quantities and units

II. Radiation Biology
(24 Hours)
1. Introduction to Radiobiology
2. Sequence of events leading to biological effects from radiation exposure
2.1. Radiation and Cellular Targets
2.1.1. Effect on macromolecules
2.1.1.1. Effect on DNA
2.1.1.2. Effect on proteins
2.1.1.3. Radiolysis of water
2.1.1.4. Direct and indirect effects
2.1.1.5. Target Theory
2.1.2. Effects on cells
2.1.2.1. Effect on chromosomes
2.1.2.2. Effect on other cellular constituents
2.1.3. Radiation effects on the organ level
2.1.3.1. Local tissue damage
2.1.3.2. Acute radiation lethality
3. General classification of radiation effects
3.1. Somatic
3.2. Genetic

4. Factors modifying radiation effects
    4.1. Biological factors
    4.2. Physical factors
    4.3. Chemical factors
5. Dose-Response relationship

III. Radiation Protection
(24 Hours)
1. Agencies responsible for formulating policies and standards in radiation protection
2. Effects of radiation protection and function of dose
    2.1. Stochastic
    2.2. Deterministic
3. Aims of radiation protection
4. Systems of dose limitation
5. Classification of radiation working area and working limits
6. Cardinal principle of radiation protection
7. Dose limits and calculations
8. Design of radiologic facilities
9. Practical radiation protection
    9.1. Personnel monitoring
    9.2. Protective apparel
    9.3. Radiation protection in pregnancy
    9.4. Technologist-Patient position
    9.5. Patient holding
    9.6. Gonadal shields
10. Protection of the radiation worker
11. Protection of the patient
12. Protection of the general public

References:

Bushong, Stewart C. Radiologic Science for Technologist: Physics, Biology, and Protection. 7th ed. St. Louis: Mosby, 2001.

Dowd, Steven B. Practical Radiation Protection and Applied Radiobiology. Philadelphia: Lea & Fabiger, 1995.

Forshier, Steve. Essential of Radiation Biology and Protection. Australia: Delmar, 2002.

Sherer, Mary Alice S. Paul J. Visconti, E. Russell Ritenour. Radiation Protection in Medical Radiography. 3rd ed. St. Louis: Mosby, 1998

DOH and PNRI Administrative Orders for the Operation of radiological Facilities

Course Title : **RADIOLOGIC PATHOLOGY**

Course Description : Study of various pathologic conditions and its effect on radiological procedures, techniques, and overall radiographic image.

Objectives	: At the end of the course, student is expected to understand various principles of disease formation, recognize common pathologic conditions and apply appropriate examination procedure and technique for best presentation of affected body part.
Credits	: 3 Units – 3 Lecture Hours/Week (54 Hours Lecture)
Term	: Third Year, Second Semester
Prerequisites	: Anatomy and Physiology Medical Terminology Radiographic Technique and Film Processing/Analysis Radiographic Positioning and Radiologic Procedures Radiologic Contrast Examinations

Course Outline:

I. General Basis of Pathologic Condition
(18 Hours)
- 1. Inflammation
  - 1.1. Biochemical
  - 1.2. Vascular
  - 1.3. Symptom
  - 1.4. Repair
- 2. Acute and Chronic Inflammation
  - 2.1. Causes and Duration
  - 2.2. Cellular/Tissue changes
  - 2.3. Outcome
  - 2.4. Example
- 3. Injury/Trauma
  - 3.1. Acute and Chronic
  - 3.2. Causes
- 4. Neoplasia
  - 4.1. Cell/Tissue changes
  - 4.2. Invasiveness and metastasis
  - 4.3. Causes of oncogenesis
  - 4.4. Benign tumor
  - 4.5. Malignant tumor
- 5. Congenital Disorders
  - 5.1. Causes
  - 5.2. End result
- 6. Nutritional imbalance
  - 6.1. Causes
  - 6.2. End result
- 7. Infectious diseases and its examples
- 8. Foreign bodies and its examples

II. Body Systems
(36 Hours)
- I. Gastrointestinal System

1.1. Congenital
1.2. Inflammation
1.3. Obstruction
1.4. Trauma/Injury
1.5. Neoplasm
1.6. Radiographic correlation

2. Liver, Gallbladder and Pancreas
    2.1. Congenital and normal anatomic variations
    2.2. Inflammation
    2.3. Stone
    2.4. Neoplasm
    2.5. Radiographic correlation
3. Respiratory Disorder
    3.1. Congenital
    3.2. COPD/Restrictive disorder
    3.3. Trauma/Injury
    3.4. Neoplasm
    3.5. Disorder that affects the pleura
    3.6. Radiographic correlation
4. Renal Disorder
    4.1. Congenital
    4.2. Inflammatory disorder
    4.3. Stone
    4.4. Injury
    4.5. Neoplasm
    4.6. Radiographic correlation
5. Cardio-Vascular Disease
    5.1. Congenital heart disease
    5.2. Acquired valvular disease
    5.3. Rheumatic heart disease and bacterial
    5.4. endocarditis
    5.5. Coronary heart disease
    5.6. Atherosclerosis and Vascular anomalies
    5.7. Neoplasm
    5.8. Radiographic correlation
6. Neurologic Disorder
    6.1. Congenital
    6.2. Inflammation
    6.3. Trauma/Injury
    6.4. Neoplasm
    6.5. Vascular anomalies
    6.6. Radiographic correlation
7. Skeletal Disorder
    7.1. Congenital
    7.2. Inflammation
    7.3 Degenerative disorder
    7.4. Neplasm
    7.4. Trauma/injury
    7.5. Radiographic correlation

8. Reproductive Disorder
    8.1. Congenital
    8.2. Inflammation
    8.3. Neoplasm
    8.4. Trauma/Injury
    8.5. Radiographic correlation

References:

Cotran, Ramzi S. and Kumar, Viray. Robbins Pathologic Basis of Disease. 6th ed. Philadelphia: W. B. Saunders, 1999.

Eisenberg, Ronald L., Cynthia A. Dennis. Comprehensive Radiographic Pathology. 2nd ed. St. Louis: C. V. Mosby, 1995.

Linn-Watson, Terriann. Radiographic Pathology. Philadelphia: W. B. Saunders, 1996.

Mace, James D., Nina Kowalczyk. Radiographic Pathology for Technologists. 3rd ed. St. Louis: Mosby Year Book, 1998.

Course Title : **COMPUTERIZED TOMOGRAPHY SCAN (CT-SCAN)**

Course Description: Study of principles involved in diagnostic imaging modalities that produce cross-sectional, transaxial, coronal and sagittal images of the human body.

Objectives : At the end of the course, student is expected to understand the principles and concept of Computerized Tomography Scan as a diagnostic imaging modality, its equipment, methodology and limitation, examination protocol, patient preparation and use of contrast agent.

Credits : 3 Units – 3 Lecture Hours/Week (54 Hours Lecture)
Term : Third Year, Second Semester
Prerequisite : Anatomy and Physiology
Radiologic Physics, Equipment and Maintenance
Radiographic Technique and Film Processing/Analysis
Radiographic Positioning and Radiologic Procedures

Course Outline:

I. Historical Development
(3 Hours)

II. Relevant Nomenclatures
(3 Hours)
1. CT-Scan tube
2. Gantry
3. Detection

4. Collimator
5. Rotate/translate
6. Computers

III. Comparison with Conventional Radiography
(6 Hours)

IV. The Scanner
(16 Hours)
1. Types of scanner
2. Scan control
3.Image quality
4. Preparation of patient, table, gantry, controls and display
5. System control
6. Console operation
7. Function keys
8. System performance
9. Image review

V. Scanning Program
(18 Hours)
1. Setting up patient
2. Setting examination parameters
3. Select scan series
4. Scout scans
5. Patient protocol, positioning and techniques
6. Photography
7. Basic CT anatomy
8. Plain and contrast examinations

VI. Advancements in CT Technology and Procedures
(8 Hours)
1. Helical/ Spiral CT
2. Multi Slice CT
3. CT Angiographies

References:

Bushong, Stewart C. Computed Tomography: Essentials of Medical Imaging. New York: McGraw-Hill, 2000.

Merran, Samuel, Jacques Hureau. CT and MRI Radiological Anatomy. Oxford: Butterworth-Heinemann, 1991.

Seeram, Euclid. Computed Tomography: Physical Principles, Clinical Applications, and Quality Control. 2nd ed. Philadelphia: W. B. Saunders, 2001.

Zeman, Robert K. Helical/Spiral CT: A Practical Approach. New York: Mcgraw-Hill, 1995.

Course Title : **MAGNETIC RESONANCE IMAGING(MRI)**

Course Description: Study of principles involved in a diagnostic imaging modality that produces cross-sectional, transaxial, coronal and sagittal images of the human body.

Objectives : At the end of the course, student is expected to understand the principles and concept of Magnetic Resonance Imaging as a diagnostic imaging modality, its equipment, methodology and limitation, examination protocol, patient preparation and use of contrast agent.

Credits : 3 Units – 3 Lecture Hours/Week (54 Hours Lecture)
Term : Third Year, Second Semester
Prerequisite : Anatomy and Physiology
Radiologic Physics, Equipment and Maintenance
Radiographic Technique and Film Processing/Analysis
Radiographic Positioning and Radiologic Procedures

Course Outline:

I. Overview
(7 Hours)
1. Historical Development
2. Relevant Nomenclatures
   2.1. Magnet
   2.2. Magnetic field
   2.3. Atomic nucleus
   2.4. Proton spin
   2.5. Larmour relationship
   2.6. Radiofrequency
   2.7. Phase coherent
   2.8. Free precision
   2.9. Relaxation time
   2.10. T2 relaxation time
   2.11. Spin density
3. Comparison with Conventional Radiography

II. Nuclear Physical Principles
(10 Hours)
1. Nuclear spin
2. Gyromagnetic ratio
3. Resonance
4. Radiofrequency field
5. Larmour frequency
6. Net magnetization
7. Spin density
8. Detection of nuclear signals
9. Phase coherent
10. Free precision

II. Imaging Technique
(10 Hours)

1. Signal-to-Noise consideration
2. Imaging method
3. Relaxation time
4. Pulse sequences
5. Calculated T1 and T2
6. Instrumentation
   - 6.1. Types of magnet
   - 6.2. Gradient system
   - 6.3. Radiofrequency transmitter
   - 6.4. Reliever coil
   - 6.5. Computer
   - 6.6. Display
   - 6.7. Image recording system
   - 6.8. Cryogens
   - 6.9.

IV. Biological effect
(7 Hours)

1. Magnetic field effect to living tissue
2. Radiofrequency field effect to living tissue
3. Contraindication of Magnetic Resonance Imaging
4. Safety measures in magnetic field

V. Basic Magnetic Resonance Imaging Anatomy
(20 Hours)

1. T1 weighted images
2. T2 weighted images
3. Intermediate
4. Neuroscanning
5. Spine scanning
6. Body scanning
7. Neck scanning
8. Pediatric scanning
9. Contrast examinations

References:

Alart, I. P. Magnetic Resonance Angiography. 2nd rev. New York: Springer, 2002.

Bushong, Stewart C. Magnetic Resonance Imaging: Physical and Biological Principles. 2nd ed. St. Louis: Mosby, 1996.

Kuperman, Vadim. Magnetic Resonance Imaging: Physical Principles and Applications. San Diego: Academic, 2000.

Merran, Samuel, Jacques Hureau. CT and MRI Radiological Anatomy. Oxford: Butterworth-Heinemann, 1991.

Woodward, Peggy, Roger D. Freimarck. MRI for Technologists. New York: McGraw-Hill, 1995.

Course Title : **INTERVENTIONAL RADIOLOGY**

Course Description: Deals with the study of the principles involved in Digital Subtraction Angiography and Interventional Radiography; the parameters of imaging and equipment employed in these subspecialties.

Objectives : At the end of the course, student is expected to acquire the knowledge of the principles involved in Digital Subtraction Angiography and Interventional Radiology, its physical foundation and various equipment and accessories, the indication of the examination as well as its advantages and disadvantages.

Credits : 3 Units – 3 Lecture Hours/Week (54 Hours Lecture)
Term : Third Year, Second Semester
Prerequisites : Anatomy and Physiology
Radiologic Physics, Equipment and Maintenance
Radiographic Technique and Film Processing/Analysis
Radiographic Positioning and Radiologic Procedures

Course Outline:

I. Digital Subtraction Angiography
(27 Hours)
1. Overview of Digital Subtraction Angiography
2. The Imaging Chain
   2.1. X-ray Generator
   2.2. X-ray Tube
   2.3. Image Intensifier
   2.4. TV Lens System
   2.5. TV Camera
   2.6. Video Signal
3. Manual Subtraction Technique
   3.1. First-Order Subtraction
   3.2. Second-Order Subtraction
4. Digital Angiography
   4.1. Analog-to-Digital Convertor
   4.2. Pixel Formation
   4.3. TV Monitor
5. Digital Subtraction Technique
   5.1. Energy Subtraction
   5.2. Temporal Subtraction
   5.3. Time Interval Difference
   5.4. Dual Energy Subtraction
   5.5. Hybrid Subtraction

6. Intra-arterial vs. Intravenous
   6.1. Percutaneous
   6.2. Cut-down
7. Patient Care in Angiographies
8. Clinical Application
   9.1. Intracranial Angiography
   9.2. Pulmonary Angiography
   9.3. Thoracic Aortography
   9.4. Abdominal Angiography
   9.5. Angiography of the Limbs
   9.6. Interventional Angiography

11. Interventional Radiology
(27 Hours)
1. Overview of Interventional Radiology
2. Therapeutic and diagnostic interventions
3. Patient management and care
4. Integral processes
   4.1. Medical aspect of procedure
   4.2. Fluoroscopy and radiography
5. Contrast media
6. Equipment and techniques in Interventional Radiology
7. The Radiologic Technologist role in angiography and intervention
8. Interventional procedures
   8.1. Percutaneous Transluminal Angioplasty
   8.2. Transcatheter Embolization
   8.3. Percutaneous Nephrostomy Tube Placement & Related Procedures
   8.4. Inferior Vena Cava Filter Placement
9. Other interventional procedures
   9.1. Lymphography
   9.2. Lymphatic injection of feet and hand

References:

Tortorici, Marianne R., Patrick Apfel. Advanced Radiographic and Angiographic Procedures with an Introduction to Specialized Imaging. Philadelphia: F. A. Davis, 1995.

Wojtowycz, Myron. Interventional Radiology and Angiography. Chicago: Year Book Medical, 1990.

Valji, Karim. Vascular and Interventional Radiology. San Diego, California: W. B. Saunders, 1999.

Zuñiga-Castañeda, Wilfrido R., S. Murthy Tadavarthy. Interventional Radiology. Baltimore: Williams & Wilkens, 1998.

Course Title : **ULTRASONOGRAPHY**

Course Description: Study of the physical foundation of Ultrasound and its application to medical diagnosis.

Objectives : At the end of the course, student is expected to understand ultrasound principles and instrumentation, scanning techniques, related anatomy and physiology, biological effects and disease condition including signs and symptoms and clinical data.

Credits : 3 Units - 3 Lecture Hours/Week (54 Hours Lecture)
Term : Third Year, First Semester
Prerequisites : Radiologic Physics, Equipment and Maintenance
Anatomy and Physiology

Course Outline:

I. Historical Development
(2 Hours)
1. Theory and methodology
2. Importance of Ultrasound in diagnosis of diseases
3. Biological effects.

II. Relevant Terminologies
(2 Hours)
1. Piezoelectric effect
2. Velocity
3. Frequency
4. Wavelength
5. Hertz
6. Soundwave
7. Attenuation
8. Acoustic impedance
9. Acoustic mismatch
10. Sound intensity notation
11. Nuggen's principle

III. Physical Principles of Diagnostic Ultrasound
(6 Hours)
1. Nature of Ultrasound
1.1. Wave equation
1.2. Resonance
1.3. Acoustic intensity and power
2. Acoustic reflection
2.1. Acoustic Impedance
2.2. Reflectivity
2.3. Scattering
3. Acoustic absorption and attenuation

IV. Diagnostic Ultrasound Instrumentation and Operation
(3 Hours)
1. Ultrasound machine
1.1. Parts and function
2. Ultrasound Transducer
2.1. Parts and function
2.2. Beam focusing
3. Ultrasonic beam
3.1. Resolution
3.1.1. Axial resolution
3.1.2. Lateral resolution

V. Operational Modes
(3 Hours)
1. A-mode
2. B-mode
3. M-mode
4. Real-time
5. Doppler
6. Linear
7. Sector
8. Static Images

VI. Ultrasound Factoring
(3 Hours)
1. Time-gain compensation
2. Power input/output gain
3. Mode display selection

VII. Image Recording
(1 Hour)
1. Photographic recording
2. Video tape recorders
3. Polaroid photography
4. Multiformat cameras
5. Setting-up of photographic system

VIII. Artifacts/Pitfalls in Ultrasonography
(2 Hours)
1. Reverberation
2. Acoustic shadowing
3. Reverse shadowing
4. Effect of beam width
5. Effects of ascites

IX. Anatomical Presentation During Real Time Scanning
(23 Hours)
1. Indications

2. Sonography of solid organs
    2.1. Brain
    2.2. Orbits
    2.3. Thyroid
    2.4. Breast
    2.5. Liver
    2.6. Gallbladder
    2.7. Spleen
    2.8. Pancreas
    2.9. Heart
    2.10. Kidney
    2.11. Prostate
    2.12. Gynecological organs
3. Obstetrical conditions
    3.1. Normal fetal development
        3.1.1. Fetal presentation
        3.1.2. Multiple gestation
        3.1.3. Placental localization
        3.1.4. Determination of age of gestation (AOG)
            3.1.4.1. Biparietal diameter
            3.1.4.2. Femoral length
            3.1.4.3. Crown-rump length
            3.1.4.4. Abdominal circumference

X. Interventional Ultrasound
(4 Hours)
1. Needle-guidance techniques
2. Biopsies
3. Aspiration and drainage procedures
4. Interventional ultrasound in obstetrics

XI. Quality Control in Ultrasonography
(3 Hours)

References:

Bushong, Stewart C. Diagnostic Ultrasound: Physics, Biology and Instrumentation. St. Louis: Mosby Year Book, 1991.

Kremkau, Frederick W. Doppler Ultrasound: Principles and Instruments. 2nd ed. Philadelphia: W. B. Saunders, 1995.

Zwiebel, William J., Roya Sohaey. Introduction to Ultrasound. Philadelphia: W. B. Saunders, 1998.

Course Title : **RADIOTHERAPY**

Course Description: Study of the precise application of ionizing radiation in the treatment of neoplastic growth, a complete and effective treatment plan as well as patient care of oncology cases.

Objectives : At the end of the course, student is expected to understand the physical principles and concepts of the therapeutic application of ionizing radiation, various oncology cases, preparation and treatment plan, and patient care.

Credits : 3 Units - 3 Lecture Hours/Week (54 Hours Lecture)
Term : Third Year, Second Semester
Prerequisites : Radiologic Physics, Equipment and Maintenance
Anatomy and Physiology

Course Outline:

I. Historical Development
(1 Hour)
1. Theory
2. Radiotherapy as specialty in medicine

II. Atom and Radioactivity
(2 Hours)
1. Atom
1.1. Fundamental particles
1.2. Atomic structure
1.2.1. Electron arrangement
1.2.2. Electron binding energy
2. Radioactivity
2.1. Radioisotopes
2.2. Radioactive half-life
2.3. Particulate radiation
2.4. Electromagnetic radiation
2.5. Modes of decay
2.6. Nuclear reaction

III. Equipment and Calibration Technique
(8 Hours)
1. Radiotherapy Units
1.1. Kilovoltage units
1.1.1. Contact
1.1.2. Supervoltage
1.1.3. Orthovoltage
1.2. Megavoltage units
1.2.1. Radioisotopes
1.2.2. LINACS
1.2.3. Betatrons
1.2.4. Van de Graaf unit
1.2.5. Cyclotron
2. Radiation Calibration Technique
2.1. Radiation calibration
2.2. Dose rate determination

2.3. Factors affecting dose rate
2.4. Dose rate as basis for isodose curve determination

IV. Principles of Isodose Planning
(13 Hours)
1. Importance of Isodose curve/Dmax of various units
2. Characteristics of isodose curve
3. Tumor localization/simulation
4. Method of Radiotherapy planning
4.1. Source-Axis distance (SAD)
4.2. Source-Skin distance (SSD)
4.3. Source-Tumor distance (STD
5. Procedure of Isodose planning
5.1. Single port
5.2. Cross fire technique
5.3. Double port
5.4. Quadrantic (box technique)
5.5. Perpendicular
5.6. Rotational
5.7. Tangential
6. Clinical Method of Treatment
6.1. Protraction technique
6.2. Fractionation technique
6.3. Split dose
6.4. Pallative vs. Curative
6.5. Pre-operative technique
6.6. Post-operative technique
6.7. Brachytherapy vs. Teletherapy
7. Dose Theory
7.1. Tissue-Air ratio (TAR)
7.2. Tissue-Max ratio (TMR)
7.3. Percentage Depth dose (PDD)

V. Radiobiologic Principles in of Ionizing Radiotherapy
(2 Hours)
1. Cellular level
2. Tissue-organ level
3. Radiosensitivity and Radiocurability

VI. Radiotherapeutic Malignancies
(24 Hours)
1. Malignancies
1.1. Tissue of origin
1.2. Tumor type
1.3. Tumor growth
1.4. Role of oxygen in tumor growth
2. Mode of spread category of cancer
2.1. Size of the primary lesion
2.2. Involvements of regional lymph nodes

2.3. Occurence of metastasis

3. Isodose technique and portals for various malignancies
   - 3.1. Carcinoma of the skin
   - 3.2. Carcinoma of the oral cavity
   - 3.3. Carcinoma of the larynx
   - 3.4. Carcinoma of the nasopharynx
   - 3.5. Hodgkin disease and malignant lymphoma
   - 3.6. Carcinoma of the breast
   - 3.7. Carcinoma of the cervix
   - 3.8. Carcinoma of the uterus
   - 3.9. Carcinoma of the lung
   - 3.10. Medulloblastoma
   - 3.11. Retinoblastoma
4. Principles in the management of malignancies
   - 4.1. Surgery
   - 4.2. Radiotherapy
   - 4.3. Chemotherapy
   - 4.4. Hyperthemia therapy
   - 4.5. Combination of modalities

VII. Care of Patient Undergoing Radiotherapy
(2 Hours)
1. Complications of Radiotherapy
2. Dietary advice
3. Care of the mouth
4. Care of the cervix

VIII. Quality Control in Radiotherapy
(2 Hours)

References:

Bentel, Bumilla Carleson. Radiation Therapy Planning. 2nd ed. New York: McGraw-Hill, 1996.

Morris, Samantha. Radiotherapy Physics and Equipment. Edinburgh: Churchill Livingston, 2001.

Washington, Charles M., Dennis T. Leaver. Principles and Practice of Radiation Therapy: Practical Applications. St. Louis: Mosby, 1997.

Williams, J. R., D. I. Thwaites. Radiotherapy Physics: In Practice. 2nd ed. New York: Oxford University Press, 2000.

Course Title : **NUCLEAR MEDICINE**

Course Description: Study of the principles and instrumentation in Nuclear Medicine and its diagnostic and therapeutic applications.

Objective : At the end of the course, student is expected to understand the principles involved in Nuclear

Medicine, its diagnostic and therapeutic applications, instrumentations and various procedures as well as the factors in radiation protection unique to this radiological specialty.

Credits	: 3 Units - 3 Lecture Hours/Week (54 Hours Lecture)
Term	: Third Year, Second Semester
Prerequisites	: Radiologic Physics, Equipment and Maintenance Anatomy and Physiology

Course Outline:

I. Physics of Nuclear Medicine
(8 Hours)
1. Atomic structure
2. Properties of radiation
3. Radioactivity
3.1. Nuclear Families
3.2. Decay processes
3.3. Schematic of radioactive decay
3.4. Radioactive units
4. Interaction of charged particles with matter.

II. Instrumentation
(8 Hours)
1. Radiation detection system
2. Scintillation camera and collimators
3. Emission Computed Tomography (SPECT & PET)
4. Quality control of Nuclear Medicine instruments
5. Computer image acquisition and processing

III. Radiochemistry and Radiopharmacology
(12 Hours)
1. Production of radionuclides
2. Radiopharmaceuticals
2.1. Technetium radiopharmaceutical
2.2. Iodinated radiopharmaceuticals
2.3. Gallium and Indium radiopharmaceuticals
2.4. Thallium Chloride
2.5. PET radiopharmaceuticals
2.6. Therapeutic radiopharmaceuticals
3. Radiopharmaceutical Quality Assurance

IV. Clinical Nuclear Medicine
(20 Hours)
1. General principles
1.1. Rationale/Indication
2. Anatomy and Physiology
3. Radionuclide imaging procedures

3.1. Central Nervous System
3.2. Endocrine System
3.3. Respiratory System
3.4. Cardiovascular System
3.5. Gastrointestinal System
3.6. Genitourinary System
3.7. Skeletal System
3.8. Inflammatory and Tumor Imaging
3.9. Hematopoietic System
4. Therapeutic Nuclear Medicine

V. Radiation Protection
(6 Hours)
1. Measurement concept
2. Radiation dose regulation
3. Sources of radiation exposure
4. Operational radiation safety
5. Radiation safety instruments and devices
6. Control of personnel radiation exposure

References:

Bernier, Donald R., Paul E. Christian, James K. Langan. Nuclear Medicine Technology and Techniques. 4th ed. St. Louis: Mosby, 1997.

Mettler, Fred A., Milton J. Guilberteau. Essentials of Nuclear Medicine Imaging. 4th ed. Philadelphia: W. B. Saunders, 1998.

Bushong, Stewart C. Radiologic Science for Technologist Physics, Biology, and Protection. 7th ed. St. Louis: Mosby, 2001

Course Title : **QUALITY ASSURANCE AND QUALITY CONTROL**

Course Description: Study of organized effort in the management of a radiological facility to ensure consistent production of high standard of quality images with minimum exposure to patient and personnel.

Objectives : At the end of the course, student is expected to have a general understanding of a good quality assurance program in medical imaging through a predetermined criteria of minimizing patient radiation exposure, maximizing film quality, reducing retake, optimizing the use of staff time as well as an ongoing assessment of variable that could affect image quality and diagnosis.

Credits : 3 Units - 2 Units Lecture; 1 Unit Laboratory
2 Hours Lecture/Week; 3 Hours Laboratory/Week
(36 Hours Lecture; 54 Hours Laboratory)

Term : Third Year, Second Semester
Prerequisites : Radiologic Physics, Equipment and Maintenance
Radiographic Technique and Film Processing/Analysis
Radiographic Positioning and Radiologic Procedures

Course Outline:

I. Overview
(6 Hours Lec.; 8 Hours Lab.)
1. Diagnostic procedure chain
2. Quality Assurance process
3. Requirements of a Quality Assurance and Quality Control

II. Quality Assurance and Quality Control Tests.
(30 Hours Lec.; 46 Hours Lab.)
1. Darkroom quality control and standard darkroom processing techniques
1.1. Basic test for darkroom facility
1.2. Darkroom quality control
1.3. Test for assessing the speed of film and film-screen combination
1.4. Test for darkroom fog and safelight
1.5. Standard darkroom processing technique
2. Departmental standards for radiographic image quality
3. Conduct of film analysis
3.1. Repeat analysis
3.2. Analysis of rejected versus repeated film
3.3. Determination of rejection rate
3.4. Distribution of rejected film
3.5. Guide to good practice
4. Viewing conditions (view boxes)
5. Intensifying Screen and Cassette
5.1. Efficiency
5.2. Screen contact
5.3. Cassette design
6. Radiographic equipment quality control tests
6.1. Peak kilovolt accuracy
6.2. Exposure time and milliamperage-second test tool
6.3. Focal spot size
6.4. X-ray output/Half-value layer
6.5. Collimator alignment
6.6. Automatic exposure termination
6.7. Beam alignment
6.8. Focus of optical system
6.9. Automatic brightness system
6.10. Aluminum step wedge
7. Standard radiographic technique chart

References:

Papp, Jeffrey. Quality Management in the Imaging Sciences. St. Louis: Mosby, 1998.

San Juan, Bayani C., et. al. Manual on Technical Quality Control in Medical Radiography. Manila: Department of Health, 1994.

Stevens, Andrea Trigg. Quality Management for Radiographic Imaging: A Guide for Technologists. New York: McGraw-Hill, 2001.

Course Title : **SEMINAR I**

Course Description: This is a sequel of Elements of Research. This will deal with the application of research from the implementation of the research design up to the making of the abstract. Submission of a hardbound copy of the approved research study is a requirement for graduation.

Credits : 3 Units - 3 Lecture Hours/Week (54 Hours)
Term : Fourth Year, Second Semester

Course Title : **SEMINAR II**

Course Description: Presents the advancement and technological innovations in the field of radiological sciences to include physics update, educational concerns, and issues and opinions of interest in the field through journal and article reviews, case presentations, symposia, and seminars.

Credits : 3 Units - 3 Lecture Hours/Week (54 Hours)
Term : Fourth Year, Second Semester

Course Title : **CLINICAL EDUCATION I**

Credits : 18 Units (1,056 Hours)
Term : Fourth Year, First Semester

Course Description: The Radiologic Technology Internship Program consists of eleven (11) months of service divided into Clinical Education I and Clinical Education II periods of 5-½ months each. The program requires the Radiologic Technology Interns to be assigned to various affiliation hospitals of the school. Satisfactory completion of the Internship Program is a requirement for graduation. The Radiologic Technology Intern shall undertake to perform or

assist in at least eight hundred (800) radiographic examination during the entire Internship period in general and specific radiographic examinations (see Appendix B).

Course Title : **CLINICAL EDUCATION II**
Credits : 18 Units (1,056 Hours)
Term : Fourth Year, Second Semester

Course Description: Continuation of Clinical Education I.

Article VII
GENERAL REQUIREMENTS

Section 10. Program Administration

10.1. The higher education institution offering Radiologic Technology Education shall be administered by a full-time Dean/Chairman/Department Head with the following qualifications:

10.1.1. Filipino citizen and of good moral character.

10.1.2. Radiologic Technologist duly licensed by the Professional Regulation Commission or a Radiologist who is a fellow of the Philippine College of Radiology.

10.1.3. teaching experience of at least five (5) years.

10.1.4. administrative and clinical experience of at least two (2) years.

10.1.5. holder of at least a Master's degree in Science, Education or Administration.

10.2. The general function and responsibility of the Dean/Chairman/Department Head of the College of Radiologic Technology is to assist the school in the implementation and attainment of instructional goals, community extension services, and in all matters affecting the general policies of the institution.

Section 11. Faculty. The faculty shall have at least one (1) year experience in clinical radiologic work and shall have the following academic preparations appropriate to their teaching assignment:

11.1 Bachelor of Science in Radiologic Technology graduate and duly licensed by the Professional Regulation Commission.

11.1.1. Holder of a Master's Degree in Science, Education or Administration.

11.1.2. A Radiologist, a licensed medical practitioner, and a medical physicist may be invited to teach provided they teach their area of specialization.

11.2. The faculty in a school offering Radiologic Technology Education shall be assigned academic ranks in accordance with their academic training and scholarship.

11.3. Full time faculty members carry a minimum teaching load of eighteen (18) credit units or the equivalent paying units per semester and eight (8) to nine (9) units during summer term. In the event of insufficient classes, priority of faculty assignment is given to permanent full time faculty members. At least sixty (60) percent of Radiologic Technology Education courses shall be taught by full-time faculty.

11.4. Membership to the teaching staff is formally acquired by a Letter of Employment issued by the President of the institution upon the recommendation of the college Dean, specifying whether appointment is temporary, full-time or part time teaching. This document will serve as the primary basis for the teacher's assignment, rank, remuneration, and eventual promotion to permanent status.

11.5. A faculty development program shall be established for effective operation of the college and for the improvement or development of the profession. This program may be carried out through:

11.5.1. scholarship grants to deserving full-time permanent faculty members.

11.5.2. provision of incentives for study towards the Master's/Doctorate degree by giving tuition fee discounts if the institution offers the graduate program or through other forms of assistance.

11.5.3. subsidizing attendance/participation in seminars, conferences, and other training programs.

Section 12. Library. Higher education institutions offering Radiologic Technology Education shall have library resources relevant to general education and Radiologic Technology program.

12.1. A librarian duly licensed by the Professional Regulation Commission shall be employed.

12.2. There shall be at least three (3) unrepeated titles of books of recent edition for every professional subject; subscriptions to radiological journals, periodicals, and relevant scientific publications; and provision for information technology (IT) resources.

12.3. The library shall provide adequate reading space, lighting, and ventilation in proportion to the student population.

Section 13. Facilities and Equipment. The curricular program offered by the higher education institution is the main determining factor in the design and the construction of its physical facilities.

13.1. The higher education institution shall provide lecture and laboratory rooms adequate for instructional and experimental activities.

13.2. Lecture rooms should have adequate space to accommodate the largest class and provided with appropriate instructional media.

13.3. Laboratory activities shall be conducted in a laboratory room designed purposely for a particular science or professional course. Separate laboratory facilities for the physical, biological, and Radiologic Sciences shall be provided.

13.3.1. The laboratory rooms should be spacious, well-lighted, well-ventilated, and provided with safety devices and first aid facilities.

13.3.2. There shall be adequate equipment, facilities, and materials for a particular laboratory science course it offers.

13.3.3. Facilities, equipment, and supplies in the science laboratory shall conform to the standards and requirements of the general sciences laboratory.

13.3.4. The equipment, accessory devices, and materials necessary in a Radiologic Sciences laboratory shall be determined and provided for specific experiments performed.

13.3.5. Experiment performed in a particular laboratory course shall be adequate in scope to cover the concepts and theories to be taught and learned; emphasize investigation and inquiry; *and* be so designed as to be undertaken by the students with a minimum of instruction from the teacher.

13.4. The radiological laboratory facility shall comply with the basic standards as well as safety requirements prescribed by the Bureau of Health Devices and Technology (BHDT) of the Department of Health (DOH), and shall be provided and equipped with the following:

13.4.1. functioning x-ray machine of at least 100 Ma
13.4.2. x-ray table with grid
13.4.3. beam restricting devices
13.4.4. processing tanks
13.4.5. developer and fixer solutions

13.4.6. thermometer
13.4.7. darkroom safe light
13.4.8. darkroom timer
13.4.9. film hanger of different sizes
13.4.10. film cassettes of different sizes
13.4.11. x-ray films of different sizes
13.4.12. film dryer or film rack
13.4.13. x-ray caliper
13.4.14. leaded aprons, gloves, and gonadal shields
13.4.15. negatoscopes
13.4.16. movable protective barrier
13.4.17. leaded blockers
13.4.18. phantom
13.4.19. quality control test tools

13.5. Equipment for presentation of audio-visual aids shall be provided.

Section 14. Admission. The following are the requirements for an applicant for admission into the Radiologic Technology Education program:

14.1. Have graduated from a general secondary course authorized by the Department of Education.

14.2. Have satisfactorily complied with admission requirements of the school.

Section 15. Instructional Standards. The institution shall maintain a high standard of instruction utilizing appropriate updated syllabi and instructional materials/procedures that contribute to sound Radiologic Technology Education. A system of supervision shall be instituted and implemented for the purpose of evaluating teaching competence.

15.1. The institution shall have competent instructional staff of good moral character classified into various academic ranks.

15.2. The higher education institution shall adopt any textbook of recent edition which reflects the current trends and advancements in the field of Radiologic Technology and which does not violate Philippine laws. Adopted basic textbooks may be changed once in every three (3) years.

15.3. The institution shall provide the students with the necessary textbooks and instructional materials, one copy of each of the basic textbook for every twenty five (25) students.

15.4. The institution must provide the necessary instructional materials, such as anatomy models, teaching slides, and charts including information technology (IT) based resources for effective teaching-learning process.

15.5. The ratio of faculty to students in a technical laboratory shall be a maximum of one is to forty (1:40).

15.6. Evaluation must be an integral part of the teaching-learning process through a variety of tests and measurements and the students informed of the results. The higher education institutions shall provide for a systematic and continuing plan of evaluation of students' progress through a grading system that is consistent with the objectives of the institution. The promotional records shall be kept in the school within the following semester for examination in cases of grievances and complaints.

15.7. The Clinical Education Training Program shall envision developing professional Radiologic Technology skills through a systematic application of scientific knowledge in diagnostic imaging and therapy in hospitals.

Section 16. Research. The higher education institution shall encourage and support research work in the field of Radiologic Sciences and shall have competent and qualified faculty capable of handling research.

16.1. Faculty members assigned to do research activities shall be credited with an equivalent teaching load for the duration of the research study.

16.2. The institution shall encourage and support research activities among its students and faculty for the furtherance of the Radiologic Technology profession.

16.3. Students should conduct research work as a requirement for graduation.

Section 17. Higher education institutions offering Radiologic Technology program should actively pursue the goal of excellence through quality education. One means of measuring the quality of education is through voluntary accreditation by appropriate accrediting agency.

Section 18. Clinical Education and Accreditation of Training Centers. See Appendix A.

Section 19. Graduation of Students. The candidate for graduation shall:

19.1. Complete all the required number of units in the Radiologic Technology Education curriculum as prescribed by the school in conformity with existing policies and standards.

19.2. Have a minimum residence of one (1) year with an academic load of not less than thirty (30) units prior to clinical education training in the school where the student is graduating.

Section 20. Comply with all other requirements prescribed by the school.

Article VIII
REPEALING CLAUSE

Section 21. This Order supersedes all previous issuances concerning Radiologic Technology Education which may be inconsistent or contradictory with any of the provisions hereof.

Article IX
EFFECTIVITY CLAUSE

Section 22. This set of Policies, Standards and Guidelines shall take effect beginning School Year 2006-2007.

CARLITO S. PUNO
Chairman

Pasig City, Philippines
April 11, 2006

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PROPOSED GUIDELINES FOR THE RADIOLOGIC TECHNOLOGY CLINICAL EDUCATION TRAINING PROGRAM

I. VISION STATEMENT

A comprehensive related learning experience in the clinical setting that ensures equity of clinical experience according to established standards and requirements of Radiologic Technology Education.

II. MISSION STATEMENT

The mission of the Radiologic Technology Clinical Education Training Program is to prepare students for the necessary skills required of a Radiologic Technologist by providing quality clinical education training and promoting growth in the student as an individual.

III. DESCRIPTION

The Radiologic Technology Clinical Education Training Program is in the fourth year level of Bachelor of Science in Radiologic Technology course. The program consists of eleven (11) months of intensive clinical training in general radiography and in the various subspecialties of Radiology in CT-Scan, MRI, Interventional Radiology, Nuclear Medicine, Radiation Therapy, and Ultrasonography. It also inculcates in the students positive values, sense of commitment to work, compassion and concern for one's fellowmen.

IV. OBJECTIVES

The program aims to provide a venue for the students to:

1. Apply knowledge of anatomy, physiology, positioning, and radiographic techniques to accurately demonstrate anatomic structures of interest.

2. Develop the skills in establishing exposure factors and evaluating radiographic images.

3. Enhance the knowledge, skills, and attitudes in the application of the principles of radiation protection as well as the laws and regulations governing the application of ionizing and non-ionizing radiation in medicine.

4. Develop competence in exercising independent judgment and discretion in the technical performance of medical imaging and therapeutic procedures.

5. Develop dynamic, competent, socially-conscious, ethical, and globally competitive Radiologic Technologists concerned with the application of State-of-the-Art scientific technique in medical imaging and therapy.

6. Develop critical thinking skills and appreciation of the technological advancement in the field of radiologic sciences through research and continuing education.

V. REQUIREMENTS FOR INTERNSHIP

1. Students admitted for training are fourth year students who passed all academic subjects from the first year to the third year.

2. Students admitted for training must undergo specific laboratory examinations and secure health clearance from the college/university physician prior to the start of training. An applicant found positive for infectious diseases (e.g. tuberculosis) shall not be allowed to undergo the training until proof of complete treatment is presented.

3. Comply with other specific requirements of the higher education institution (HEI).

VI. GENERAL RULES ON INTERNSHIP TRAINING

1. The HEI, in coordination with the affiliated hospitals, shall provide a training program in accordance with established guidelines.

2. The HEI shall enter into a contract of affiliation with hospitals with radiological facilities duly licensed by the DOH-Bureau of Health Devices and Technology and the DOST-Philippine Nuclear Research Institute.

3. The Radiologic Technology Clinical Training Program shall be divided into Clinical Education I and Clinical Education II of at least five and a half months (5-1/2) each period.

4. A clinical coordinator shall be provided by the HEI to monitor students' attendance, behavior, and performance in coordination with the chief Radiologic Technologist/training officer of the affiliated training center.

5. Radiologic Technology interns shall undergo a minimum of eight (8) hours hospital duty per day, five (5) days a week, and shall observe, assist, and perform in at least eight hundred (800) general radiographic examinations and two hundred (200) specialized radiologic procedures during the entire training period.
   5.1. A record of the examinations done shall be contained in a logbook duly signed by the radiologic technologists-in-charge, training officer or chief radiologic technologist of the hospital concerned and submitted at the end of training.
   5.2. One (1) day a week shall be spent in school in addition to the five (5) clinical duty days.
   5.3. The total number of hours for internship in a week is forty-eight (48) hours for a total of two thousand one hundred twelve (2,112) hours for the 11-month training period.

6. An intern who incurred accumulated unexcused absences of more than thirty (30) duty days in any period of the program (Clinical Education I or Clinical Education II) shall be DROPPED from the program.

7. An intern, who, for some reason, cannot continue/enroll in the Clinical Education II, may continue/enroll in the Clinical Education II the following enrolment period. If the said Intern cannot enroll in the Clinical Education II after four (4) enrolment periods (after two years), he/she shall be required to repeat Clinical Education I if he/she wishes to continue the course.

VII. DUTIES AND RESPONSIBILITIES OF INTERNS

1. Radiologic Technology interns shall abide with the rules and regulation of their affiliate hospitals and shall wear complete prescribed uniform. Above all, interns shall maintain decorum and professional excellence in the performance of their duties. Any infraction of the rules and regulations of the affiliate center shall carry a specific disciplinary action and this shall be reported to the school authorities within a reasonable period of time.
   1.1. Interns are expected to behave as professionals at all times attending to their duties promptly and faithfully and respecting hospital property with regard to its proper maintenance and utilization.
   1.2. Patients must be treated with compassion, kindness, and consideration. Patient's information must be handled with utmost confidentiality.
   1.3. Interns must avoid undue familiarity and intimacy with patients and staff of affiliation hospitals.
   1.4. Interns shall maintain harmonious working relationship with fellow interns and other personnel of the affiliation hospitals.
   1.5. Interns are not allowed to accept fees, gifts, or presents in any form from patients.
   1.6. Interns are bound by the Code of Ethics in the practice of Radiologic Technology profession.

2. Interns must observe protocol for radiation protection, maintain cleanliness of work areas and adhere to the provisions of *universal precaution* for health workers. The intern should provide for himself/herself the paraphernalia necessary for precaution.

3. Absences shall be strictly dealt with. Interns shall adhere strictly to the policies of the HEI and affiliated hospitals on attendance and punctuality.

4. The Intern shall be solely responsible for payment, replacement or repair of damaged hospital equipment and wasted supplies incurred by him/her after due process. The Intern is likewise held responsible for injury inflicted on a patient, accidental or otherwise.

VIII. MERITS, OFFENSES AND SANCTIONS

1. Merit is given to an Intern whose character, conduct or achievement is deserving of reward, honor or esteem, which shall be given an equivalent number of days as determined by the HEI. However, merits cannot erase extension of duties due to absences or tardiness.
   1.1. Meritorious deeds must be indorsed by the clinical instructor, training officer or chief radiologic technologist and approved by the dean and/or department chairman.

2. The following acts and offenses committed within hospital premises (on-duty or off-duty) warrant disciplinary action as determined by the HEI's disciplinary measures:
   1.1. smoking
   1.2. gambling and playing games
   1.3. use of telephone for personal calls
   1.4. entertaining visitors
   1.5. doing crafts (e.g. needlework)
   1.6. vending
   1.7. using cellular phone within the workplace
   1.8. sleeping
   1.9. watching television
   1.10. alcohol intoxication
   1.11. inflicting injury
   1.12. carrying deadly weapons
   1.13. possession or use of prohibited drugs
   1.14. sexual harassment
   1.15. vandalism/willful destruction of hospital properties
   1.16. stealing
   1.17. bringing pornographic materials
   1.18. immorality
   1.19. issuing any certificate or give out statements to the press or outside agencies concerning patients in the hospital
   1.20. bringing out hospital charts, x-ray films/results for any reason
   1.21. insubordination and discourtesy to superiors, hospital personnel, doctors, patients and their companions
   1.22. any form of dishonesty and mischief
   1.23. other forms of misconduct not herein enumerated that deserve disciplinary action as determined by the Dean, Department Chairman or Intern Coordinator.

IX. RESPONSIBILITIES OF THE HIGHER EDUCATION INSTITUTION AND THE AFFILIATED TRAINING CENTERS

1. Responsibilities of the HEI. The HEI shall:

1.1. Coordinate with the affiliation hospitals in implementing the Radiologic Technology clinical education training program.
1.2. Provide a clinical coordinator who is experienced in actual radiological works to monitor interns' attendance, behavior, and performance in coordination with the affiliation hospitals.
1.2.1. The clinical coordinator shall have the following qualifications:
1.2.1.1. A registered Radiologic Technologist.
1.2.1.2. At least one (1) year clinical and one (1) year teaching practice.
1.3. Ensure that the clinical coordinators and interns observe and abide with the policies, rules, and regulations of the affiliation hospitals.
1.4. Ensure that the interns pay or replace damaged equipment and wasted supplies incurred as well as hospital expenses on injury inflicted on a patient before graduation.
1.5. Implement sanctions on offenses incurred by the interns in coordination with the affiliation hospitals.

2. Responsibilities of the Affiliated Hospitals. The affiliated hospitals shall:

2.1. be a duly licensed radiological facilities by the DOH–Bureau of Health Devices and Technology and/or the DOST–Philippine Nuclear Research Institute.
2.2. coordinate with the HEI in the preparation and review of the training program.
2.3. provide a certificate of completion for each intern at the end of rotation.
2.4. allow interns to attend/participate official school activities/functions when requested by the Dean or Department Chairman without sanction.

3. Joint Responsibilities of the HEIs and the Affiliated Hospitals.

3.1. Prepare, adopt, and review the clinical education training program.
3.2. Establish a minimum number of training hours and a fixed ratio of 4:1 Interns to Radiologic Technologist.
3.3. Hold conferences/meetings, as the need arises, to monitor and evaluate the implementation of the program.
3.4. Maintain cooperation and harmonious relationship among the interns and staff of the affiliation training centers.
3.5. Affiliation fee shall include:
3.5.1. hospital affiliation fee
3.5.2. honorarium for staff-in-charge of training

X. SERVING OF EXTENSION OF DUTY

1. Make-up for extension of duties due to absences and/or demerits is allowed only after the end of the 11-month training.

2. Schedule for serving extensions shall be made by the clinical coordinator and approved by the dean or department chairman and shall commence immediately after the end of regular training period or as scheduled.

3. Serving of extensions should be completed within one year. If the intern does not finish serving his/her extensions within a year, he/she shall be required to enroll Clinical Education II if he/she wants to graduate from the course.

4. Extension duties of more than twelve (12) hours per shift are not allowed.

5. An extension fee shall be charged as determined by the HEI.

6. Penalties for offenses imposed during regular internship shall apply during serving of extensions.

XI. TRAINING METHODOLOGY

The training methodology shall include, but not limited to, the following:

1. Actual performance of radiological procedures and examinations.

2. Assignment of the interns in specialized modalities, e.g. CT-Scan, MRI, Nuclear Medicine, Radiation Therapy, etc., if such services are available.

3. Lectures, reporting, and/or technical paper presentations.

XII. PERFORMANCE EVALUATION

1. Performance evaluation of the interns shall include:
   1.1. Theoretical examinations (30%).
   1.2. Clinical performance (70%).

2. Examinations/clinical competency evaluation shall be conducted by the clinical coordinator and the training officer or the chief radiologic technologist of the affiliation hospitals.

Appendix B

REQUIRED NUMBER OF EXAMINATIONS PER REGION

The following constitute the minimum number of examinations that the Radiologic Technology Intern will undertake to perform or assist during the period of clinical training. This list of examinations shall be recorded in a logbook duly prescribed for this purpose.

A. General Radiography

a. Upper Limb 75
b. Shoulder Girdle 50
c. Pelvic Girdle, Hip Joint and Upper 3rd Femur 25
d. Lower Limb 90
e. Vertebral Column 80
f. Thoracic Cage 25
g. Thoracic Contents 150
h. Skull 70
i. Abdomen 70

B. Special Radiologic Procedures

a. Biliary System 40
b. Urinary System 25
c. Barium Cases (UGIS, BAE, Esophagogram, etc.) ... 75
d. Pregnancy (Pelvimetry/Fetography) 5
e. Other Examinations (Sialography, Hystero-salpingography, Interventional procedures, etc.) ... 20

C. In addition, a minimum of two hundred (200) cases in the following specialty areas must be undertaken:

a. Computed Tomography
b. Magnetic Resonance Imaging
c. Ultrasound
d. Radiotherapy
e. Nuclear Medicine