The Curriculum Guide

for

Radiography Programs

The American Society of Radiologic Technologists

THE AMERICAN SOCIETY OF RADIOLOGIC TECHNOLOGISTS

The Curriculum Guide For Radiography Programs - 1982

Preface

Educators recognize that a curriculum guide is not static, but rather a dynamic instrument, reflecting progress and change. The Curriculum Guide for Radiography Programs supports this concept. Technological change and improved professional understanding of educational methodology were the stimulus for revision of the Curriculum Guide.

Radiography education is the responsibility of those qualified by preparation and experience to assume that important task. The guide concept is reflected in the Curriculum composition. Unit objectives are provided. Educators are expected to expand the general objectives and develop additional to enhance the educational program. The objectives are not weighted. It is the opinion of the American Society of Radiologic Technologists that all objectives must be satisifed to produce a competent radiographer.

The units have been placed in a sequence that appears reasonable and realistic. It is the responsibility of the educator to structure a sequence based on individual program characteristics and resources. Our ultimate goal is quality education to produce competent and proficient radiographers.

The Curriculum Guide for Radiography Programs represents input from the broad community of interest. A special sub-committee of the Committee on Education provided the first draft. That draft was distributed to groups of radiography educators and radiology managers throughout the country for review and comment. All comments were carefully and thoughtfully considered in the development of this publication.

In addition to the members of the sub-committee, there are several who deserve special recognition for their contributions. Thomas J. Edwards, Jr., III, R. T.; Mary Alice Statkiewicz, R. T.; Saundra L. Warner, R. T. and Perry Sprawls, Ph.D., gave their special expertise to selected units. Marilyn Holland, R. T. and Tim Penning, R. T., provided support, encouragement and final review as the Director of Education rewrote and edited the final version. Anna Filipkowski of the ASRT Education Department provided typing and proofreading so essential to any publication. The American Society of Radiologic Technologists is grateful to all who contributed to the production of this Curriculum Guide.

A bibliography has been included. This bibliography contains the references utilized in development of the Curriculum Guide. The bibliography is provided as a resource, the American Society of Radiologic Technologists does not endorse publications included within this bibliography, with the exception of its own.

Finally, it is appropriate to include a statement from the Forward of the 1976 version to reinforce the ongoing commitment of the ASRT toward this Curriculum Guide.

> "We hope that this Guide will be helpful to you in providing the best possible education for your students."

The American Society of Radiologic Technologists

Committee on Education (1981-1982)

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INTRODUCTION TO RADIOGRAPHY

This unit will provide the student with an overview of radiography and its role in health care delivery. Student responsibilities will be outlined. Students will be oriented to academic and administrative structure, key departments and personnel, and to the profession as a whole. Basic principles of radiation protection will be introduced.

I. **Introduction to the Educational Program**

II. **The Health Care Delivery System**

III. **Hospital Organization**

IV. **Department of Radiology Organization**

V. **Accreditation and Credentialing**

VI. **Professional Organizations**

VII. **Professional Development**

VIII. **Basic Radiation Protection**

INTRODUCTION TO RADIOGRAPHY

I. Introduction to the Educational Program

A. General Information

1. Student insurance
2. Textbooks
3. Dress code
4. Policies
   - -Absence
   - -Attendance
   - -Disciplinary
   - -Educational rights
   - -Grading
   - -Grievance/appeal
   - -Health
   - -Pregnancy
   - -Tuition/fees
   - -Vacation
   - -Other
5. Educational schedules
   - -Didactic
   - -Clinical
6. Graduation requirements
7. Other

B. Clinical Education Center(s)

1. Rules and Regulations
2. Schedules
   - -Patient
   - -Staff
   - -Conference
3. Equipment
4. Records
5. Medical emergencies
6. Incident reports
7. Security
8. Other

C. Duties/Responsibilities of the Student Radiographer

1. Didactic
   - -Attendance
   - -Schedule
   - -Assignments
   - -Testing/evaluation
2. Laboratory
   - -Attendance
   - -Schedule
   - -Assignments
   - -Supervision

3. Clinical
   - -Attendance
   - -Schedule
   - -Assignments
   - -Patient care
   - -Supervision
   - -Testing/evaluation

Objectives:

1. Identify and provide a rationale for program policies
2. Explain various program policies
3. Explain clinical education center(s) rules and regulations
4. Identify major duties/responsibilities of a student radiographer

II. The Health Care Delivery System

A. Radiologic Technology

1. Radiography
2. Radiation Therapy Technology
3. Nuclear Medicine Technology
4. Diagnostic Medical Sonography

B. Audiology

C. Medical Records

D. Medical Technology

E. Medicine (Physicians)

F. Nursing

G. Occupational Therapy

H. Pharmacy

I. Physical Therapy

J. Respiratory Therapy

K. Social Services

L. Speech Pathology

M. Other

INTRODUCTION TO RADIOGRAPHY

Objectives:

1. Identify modalities of Radiologic Technology
2. Describe the function of each modality
3. Identify other components of the health care delivery system
4. Describe the function of each component as members of the health care team

III. Hospital Organization

A. Philosophy/Mission

B. Administrative Services

1. Governing board
2. Medical director
3. Administrator
4. Staff
   - -Medical
   - -House
5. Students
   - -Health professions
   - -Nursing
   - -Medical
6. Admissions
7. Medical records
8. Business offices
9. Personnel department

C. Radiological Services

1. Radiography
2. Radiation therapy technology
3. Nuclear medicine technology
4. Diagnostic medical sonography

D. Other Patient Services

1. Clinics
2. Medical laboratories
3. Nursing
4. Pastoral care
5. Pharmacy
6. Rehabilitation
7. Social service
8. Other

Objectives:

1. Discuss the philosophy and mission of the hospital
2. Identify key administrative personnel and discuss their relationship with the radiology department
3. Describe relationships and interdependencies of departments within the hospital.

IV. Department of Radiology Organization

A. Administration
1. Administrator/Director/Chairman
2. Organizational chart
3. Chain of command

B. Patient Services
1. Schedules
2. Staff

C. Education
1. Radiography program
2. Other radiologic technology programs
3. Residency program(s)
4. Staff in-service

Objectives:

1. Identify key personnel and discuss their function in the Radiology department
2. Explain patient services available in the Radiology department
3. Discuss the education available in the Radiology department

V. Accreditation and Credentialing

A. Accreditation
1. Definition
2. Agencies
   - -The Joint Review Committee on Education in Radiologic Technology
   - -The Committee on Allied Health Education and Accreditation — American Medical Association
   - -Regional and/or State
3. Essentials and Guidelines of an Accredited Educational Program for the Radiographer

B. Credentialing

1. Definitions
   - -Certification
   - -Licensure
   - -Registration
2. Agencies
   - -The American Registry of Radiologic Technologists
   - -State

Objectives:

1. Define accreditation, credentialing, certification, licensure and registration
2. Describe how the Essentials and Guidelines of an Accredited Educational Program for the Radiographer relate to the educational program
3. Explain the difference between the accreditation and credentialing processes and identify agencies involved in each process

VI. Professional Organizations

A. Purpose, Functions and Activities

B. National/International

1. The American Society of Radiologic Technologists
2. The International Society of Radiographers and Radiological Technicians
3. The American College of Radiology
4. The Radiological Society of North America

C. Region/State/District

Objectives:

1. Describe purposes, functions and activities of professional organizations
2. Identify national, state and district organizations for the radiographer

VII. Professional Development

A. Career Mobility

1. Employment outlook
2. Economic return

B. Career Advancement
1. Other radiologic technology modalities
2. Administration/education
3. Advanced technology
   - -New imaging techniques
   - -Research
4. Commercial
5. Government

C. Continuing Education
1. Definition
2. Rationale/benefits
3. Opportunities

Objectives:

1. Discuss the general employment outlook and economic return for the graduate radiographer
2. Discuss career advancement and opportunities for the radiographer
3. Identify the benefits of continuing education as related to improved patient care and professional enhancement

VIII. Basic Radiation Protection

A. Purpose
1. Patient
2. Personnel

B. Principles
1. Patient safety
   - -Pregnancy
   - -Beam limiting
   - -Shielding
2. Personnel safety
   - -Pregnancy
   - -Beam limiting
   - -Shielding
   - -Distance

C. Personnel Monitoring
1. Devices
2. Reports

Objectives:

1. Explain the purpose of radiation protection as it relates to patients and personnel

2. Discuss principles of radiation protection as they apply to patients and personnel

3. Describe student responsibility for radiation protection

4. Identify personnel radiation monitoring devices, describing advantages and disadvantages of each

5. Outline departmental rules/regulations concerning personnel monitoring

6. Interpret a periodic personnel exposure report

INTRODUCTION TO RADIOGRAPHY

1. Essentials and Guidelines of an Accredited Educational Program for the Radiographer, the American Medical Association

2. Gurley/Callaway/etal; Introduction to Radiologic Technology, 1982, Multi-Media Publishing Company

MEDICAL ETHICS AND LAW

This unit will provide the student with a definition of ethical and legal practice. The ethical and legal responsibilities of the professional relative to health care delivery is presented.

I. **Ethics**

II. **Scope of Practice for the Radiographer**

III. **Legal Considerations**

IV. **Patient Consent**

V. **Hospital and Departmental Policies**

VI. **Forensic Radiography**

MEDICAL ETHICS AND LAW

I. Ethics

A. Definitions
1. Moral
2. Professional

B. Patient
1. Values
2. Principles/standards
   -Patient Bill of Rights

C. Professional
1. Values
2. Principles/standards
   -The American Society of Radiologic Technologists Code of Ethics

D. Problem Solving

Objectives:

1. Define moral and professional ethics
2. Describe ethical values and principles/standards of patients
3. Given the Patient Bill of Rights, discuss how its provisions relate to patient ethical values and principles/standards
4. Describe ethical values and principles/standards of radiographers
5. Given the American Society of Radiologic Technologists Code of Ethics, discuss how it relates to professional ethical values and principles/standards
6. Given simulated situations, solve problems in terms of accepted professional standards

II. Scope of Practice for the Radiographer

A. Definition

B. Elements

C. Limits of Responsibility

MEDICAL ETHICS AND LAW

Objectives:

1. Discuss the American Society of Radiologic Technologists Scope of Practice for the Radiographer and describe the elements that comprise it

2. Discuss the limits of responsibility for the Radiographer as determined by the Scope of Practice

III. Legal Considerations

A. Professional Liability

1. Definitions
   - -Direct
   - -Indirect
2. Protection

B. Professional Negligence

1. Definitions
   - -Gross
   - -Contributory
2. Elements of Malpractice
   - -Duty
   - -Breach
   - -Cause
   - -Damages
3. Doctrines
   - -Borrowed servant
   - -Res ipsa loquitur
   - -Respondeat superior
4. Legal and professional standards
   - -Standard of care
   - -Established practice
5. Protection
   - -Institutional
   - -Professional

Objectives:

1. Define
   - -Direct professional liability
   - -Indirect professional liability
   - -Gross negligence
   - -Contributory negligence

2. Describe the elements necessary for a valid malpractice claim

3. Discuss the doctrines of
   - -Borrowed servant
   - -Res ipsa loquitur
   - -Respondeat superior

4. Identify legal and professional standards and describe how each relates to radiography practice

5. Discuss institutional and professional liability protection available to the radiographer

IV. Patient Consent

A. Definition

B. Types
1. Written
2. Oral
3. Implied

C. Conditions for Valid Consent
1. Legal age and mentally competent
2. Offer consent voluntarily
3. Adequately informed regarding case/treatment/procedure being recommended

D. Legal Theories
1. Battery
   - -Definition
   - -Elements
2. Negligent non-disclosure
   - -Definition
   - -Elements of malpractice
   - -Physician's duty to disclose
   - -Majority/minority rule disclosure standard
   - -Exceptions to disclosure
   - -Res ipsa loquitur

E. Standards for Disclosure (AHA & JCAH)
1. Nature
   - -Descriptions of procedure in terms patient can understand
2. Risks
   - -Disability
   - -Death
3. Alternatives and risks
4. Results
   - -Recuperation time
   - -Recuperation complications

F. Documentation of Consent
1. Consent form and contents
   - -General forms
   - -Specific forms
   - -Signatures

2. Use of consent forms in legal action
   -Admission of evidence
   -Effect on the burden of proof

Objectives:

1. Define informed consent
2. Describe the elements necessary for informed consent
3. Discuss legal theories relating to informed consent
4. Discuss standards for disclosure relating to informed consent
5. Given radiographic procedures, describe how consent forms are utilized
6. Describe the use of consent forms in court action

V. Hospital and Departmental Policies

A. Patient Records

1. Reports
   -Hospital
   -Departmental
2. Authorizations
3. Ownership/availability
4. Release
5. Other

B. Information To/Regarding Patient

1. Explanation/reinforcement of procedures
2. Inquiries
   -Radiation protection
   -Diagnosis
   -Prognosis
   -Telephone
   -Other
3. Other

C. Documentation/Reporting

1. Clinical history
2. Exposure factors
3. Contrast media
   -Type
   -Volume
   -Administration
4. Unusual occurances

D. Confidentiality

1. Patient/patient records
   - -Adult
   - -Minor/infant
   - -Family/responsible party
2. Professional
   - -Student
   - -Staff
3. Institutional
   - -Department
   - -Medical records
   - -Computer access
   - -Financial records
4. Release of information

Objectives:

1. Describe ethical and legal impacts on hospital and departmental patient records
2. Discuss ownership and availability of patient records
3. Given situations, respond to various patient information inquiries
4. Discuss the importance of documenting/reporting patient/examination information
5. Discuss aspects of confidentiality as they relate to the patient, professional, institution and release of information

VI. Forensic Radiography

A. Definition

B. Ethical Considerations

1. Respect
2. Confidentiality

C. Legal Considerations

1. Identifications/marking radiographs
2. Preservation of evidence
3. Testimony
   - -Deposition
   - -Court

D. Location Considerations

1. Radiology department
   - -Transporting body
   - -Seclusion from patients
   - -Contamination
   - -Clean up
2. Morgue
   - -Availability of equipment/supplies
   - -Positioning assistance
   - -Contamination

Objectives:

1. Define forensic radiography
2. Discuss ethical considerations of forensic radiography
3. Discuss legal considerations of forensic radiography
4. Describe location considerations in radiographing a body in the radiology deparment
5. Describe location considerations in radiographing a body in the morgue

MEDICAL ETHICS AND LAW

1. Annas/Glantz/Katz; The Rights of Doctors, Nurses and Allied Health Professionals, 1981, Avon Books

2. Code of Ethics for Radiologic Technologists, The American Society of Radiologic Technologists

3. Ehrlich/Givens; Patient Care in Radiography, 1981, C. V. Mosby Company

4. Gurley/Callaway/etal; Introduction to Radiologic Technology, 1982, Multi-Media Publishing Company

5. Scopes of Practice and Position Descriptions in Radiologic Technology, The American Society of Radiologic Technologists

MEDICAL TERMINOLOGY

This unit will provide the student with the elements of medical terminology. The origins of medical terminology are set forth. A word building system is introduced and specific terminology for the body is related. Abbreviations and symbols are addressed. Understanding radiographic orders and diagnostic reports are discussed.

I. **Origins**

II. **Word Building**

III. **Abbreviations and Symbols**

IV. **Terminology Relating to the Human Body**

V. **Understanding Radiographic Orders and Diagnostic Reports**

MEDICAL TERMINOLOGY

I. Origins

A. Primary Language Sources
1. Greek
2. Latin

B. Secondary Language Sources
1. English
2. French
3. German
4. Other

Objectives:

1. List primary languages from which medical terms are derived
2. List secondary languages from which medical terms are derived
3. List examples of medical terms from primary and secondary language sources

II. Word Building

A. Elements
1. Prefixes
2. Roots
3. Suffixes

B. Combining Forms

C. Parts of Speech
1. Nouns
2. Verbs
3. Adjectives
4. Adverbs

Objectives:

1. Given terms, separate and define each according to its elements
2. Given terms in noun or verb form, change each to an adjective or adverb
3. Given medical terms, translate into language a patient can understand

MEDICAL TERMINOLOGY

I. Abbreviations and Symbols

A. Role in Communication

B. Abbreviations
1. Examples
2. Interpretations

C. Symbols
1. Examples
2. Interpretations

Objectives:

1. Given abbreviations, provide definitions for each
2. Given symbols, provide definitions for each
3. Given medical orders which include abbreviations and symbols, translate into non-medical language

IV. Terminology Relating to the Human Body

A. Terms for Body Organization
1. Cells
2. Tissues
3. Organs
4. Systems

B. Terms for Body Cavities
1. Cranium
2. Thorax
3. Abdomen
4. Pelvis

C. Terms for Divisions of the Body
1. Abdominal regions
2. Abdominal quadrants
3. Spinal regions

D. Terms Relating to Body Systems
1. Skeletal
   - -Anatomical structures
   - -Diseases/conditions
2. Muscular
   - -Anatomical structures
   - -Diseases/conditions

3. Digestive
   - -Anatomical structures
   - -Diseases/conditions
4. Respiratory
   - -Anatomical structures
   - -Diseases/conditions
5. Urinary
   - -Anatomical structures
   - -Diseases/conditions
6. Reproductive
   - -Anatomical structures
   - -Diseases/conditions
7. Circulatory
   - -Anatomical structures
   - -Diseases/conditions
8. Reticuloendothelial
   - -Anatomical structures
   - -Diseases/conditions
9. Endocrine
   - -Anatomical structures
   - -Diseases/conditions
10. Nervous
    - -Anatomical structures
    - -Diseases/conditions
11. Sense Organs
    - -Anatomical structures
    - -Diseases/conditions

Objectives:

1. Give examples of
   - -Types of cells
   - -Body tissues
   - -Human organs
   - -Body systems

2. Describe body cavities and provide examples of organs found in each cavity

3. Given diagrams of the abdomen, label
   - -Abdominal regions
   - -Abdominal quadrants

4. Given an illustration of the lateral vertebral column, label the anatomical regions of the spine

5. Define terms relating to anatomical structures, diseases and conditions for various body systems

MEDICAL TERMINOLOGY

V. Understanding Radiographic Orders and Diagnostic Reports

A. Imaging Procedures Ordered

B. Patient History/Clinical Information

C. Interpretation

Objectives:

1. Given radiographic orders, describe the procedures to be performed
2. Given diagnostic reports, translate into language the patient can understand

MEDICAL TERMINOLOGY

1. Caldwell/Hegner; Foundation for Medical Communication, 1978, Reston Publishing Company

2. Chabner; The Language of Medicine, 1976, W.B. Saunders

3. Dorland's Illustrated Medical Dictionary, 26th Edition, 1981, W.B. Saunders

4. Gurley/Callaway/etal; Introduction to Radiologic Technology, 1982, Multi-Media Publishing Company

5. Miller/Keane; Encyclopedia and Dictionary of Medicine, Nursing and Allied Health, 2nd Edition, 1978, W.B. Saunders

6. Smith/Davis; Medical Terminology — A Programmed Text, 1963, Wiley & Sons

7. Smith/Davis; Quick Medical Terminology, 1972, Wiley & Sons

METHODS OF PATIENT CARE

This unit will provide the student with concepts of patient care including considerations of physical and psychological conditions. Routine and emergency patient care procedures will be described. The role of the radiographer in patient education will be identified. Aspects of death and dying will be discussed.

I. **Introduction to Patient Care**

II. **General Patient Care**

III. **Obtaining Vital Signs**

IV. **Emergencies**

V. **Infection Control**

VI. **Asepsis**

VII. **Contrast Media**

VIII. **Patient Education**

IX. **Interacting with the Terminally Ill**

METHODS OF PATIENT CARE

I. Introduction to Patient Care

A. Responsibilities of the Health Care Facility

1. Caring for ill and trauma patients
2. Promoting health
3. Preventing disease
4. Education
   - -Patient
   - -Health care team
5. Research

B. Responsibilities of the Radiographer

1. Performing radiologic examinations
2. Assisting the radiologist
3. Patient care
   - -Physical needs
   - -Psychological support
   - -Radiation protection/safety
   - -Patient education

Objectives:

1. Discuss the responsibilities of the health care facility as related to
   - -Caring for ill and trauma patients
   - -Promoting health
   - -Preventing disease
   - -Education
   - -Research

2. Discuss the responsibilities of the radiographer as related to
   - -Performing radiologic examinations
   - -Assisting the radiologist
   - -Patient care

II. General Patient Care

A. Principles of Body Mechanics

B. Patient Transfer Techniques

1. Wheelchair to table/table to wheelchair
2. Stretcher to table/table to stretcher
3. Wheelchair to bed/bed to wheelchair
4. Stretcher to bed/bed to stretcher
5. Three man lift
6. Drawsheet lift
7. Other

C. Turning the Patient
1. Patient condition
2. Mechanics
3. Safety

D. Restraint Techniques
1. Trauma Patient
2. Pediatric patient
3. Geriatric patient
4. Physically handicapped patients
5. Emotionally disturbed patients
6. Other

E. Methods of Administering Parenteral Fluids
1. Intravenous
   - -Description/purpose
   - -Considerations
2. Intramuscular
   - -Description/purpose
   - -Considerations
3. Subcutaneous
   - -Description/purpose
   - -Considerations
4. Intra-arterial
   - -Description/purpose
   - -Considerations

F. Aspects of Patient Comfort
1. Support
2. Warmth
3. Privacy

G. Patient Considerations
1. Trauma
2. Pediatrics
3. Geriatrics
4. Physically handicapped
5. Emotionally disturbed
6. Other

H. Specific Patient Conditions
1. Tubes/catheters
   - -Nasogastric
   - -Chest
   - -Urinary
   - -Intravenous
   - -Oxygen
   - -Other
2. Casts
3. Surgical
4. Cardiac

5. Unconscious
6. Disoriented
7. Alcoholism
8. Other

I. Bed Pans/Urinals

J. Security of Patient Property
1. In patient
2. Out patient

Objectives:

1. Describe and demonstrate principles of body mechanics applicable to patient care

2. Demonstrate techniques for patient transfer
   - -Wheelchair to table/table to wheelchair
   - -Stretcher to table/table to stretcher
   - -Wheelchair to bed/bed to wheelchair
   - -Stretcher to bed/bed to stretcher
   - -Three man lift
   - -Drawsheet lift

3. Describe and demonstrate procedures for turning patients with the following conditions:
   - -Severe trauma
   - -Unconscious
   - -Disoriented
   - -Amputee

4. Describe and demonstrate restraint techniques for various types of procedures and patient conditions

5. Discuss the administration of parenteral fluids in terms of methods, description/purpose and considerations

6. Describe the aspects of patient comfort and discuss the importance of each to the care and safety of the patient

7. Given specific patient considerations and conditions, discuss various aspects of general patient care

8. Discuss procedures for assuring security of the property of in patients and out patients

III. Obtaining Vital Signs

A. Definitions
1. Temperature
2. Pulse
3. Respiration
4. Blood pressure

B. Physiological Principles of Each

C. Normal Values

D. Equipment

E. Records

Objectives:

1. Describe vital signs used to assess patient condition
2. Explain the physiological principles related to temperature, pulse, respiration and blood pressure
3. Identify normal values for clinical measurement of temperature, pulse, respiration and blood pressure
4. Discuss the use and maintenance of equipment used for measuring vital signs
5. Record the measurement of vital signs

IV. Emergencies

A. Types
1. Cardiac arrest
2. Anaphylactic shock
3. Convulsion/seizure
4. Hemorrhage
5. Apnea
6. Vomiting
7. Aspiration
8. Suspected/confirmed fractures
9. Diabetic coma/insulin reaction
10. Other

B. Determination/Evaluation
1. Vital signs
2. Institutional medical emergency code

5. Unconscious
6. Disoriented
7. Alcoholism
8. Other

I. Bed Pans/Urinals

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1. In patient
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10. Other

B. Determination/Evaluation
1. Vital signs
2. Institutional medical emergency code

C. Acute Care Procedures
1. Cardiopulmonary resuscitation
2. Hemorrhage control
3. Suction
4. Other

D. Equipment/Supplies
1. Oxygen
2. Aspirator
3. Resuscitator
4. Medications
5. Emergency Cart
6. Other

Objectives:

1. Identify symptoms which manifest the following emergencies
   - -Cardiac arrest
   - -Anaphylactic shock
   - -Convulsion/seizure
   - -Hemorrhage
   - -Apnea
   - -Vomiting
   - -Aspiration
   - -Suspected/confirmed fractures
   - -Diabetic coma/insulin reaction
   - -Other
2. Describe the emergency medical code system for the institution and discuss the role of the student in this procedure
3. Demonstrate CPR competency and maintain certification
4. Discuss acute care procedures for the above emergencies
5. Discuss the use of medical emergency equipment and supplies
6. Given simulations, demonstrate the use of oxygen equipment

V. Infection Control

A. Definitions
1. Infectious pathogens
2. Communicable disease
3. Nosocomial infection
4. Other

B. Isolation Techniques
1. Category
2. Purpose
3. Procedure

C. Infection Sources
1. Bacteria
2. Virus
3. Other

D. Transmission Modes
1. Aerobic
2. Contact
3. Other

E. Procedures
1. Institutional
2. Departmental

F. Psychological Considerations

Objectives:

1. Define
   - -Infectious pathogens
   - -Communicable disease
   - -Nosocomial infection
2. Discuss the utilization of isolation techniques
3. Demonstrate isolation technology including room required, use of gowns/masks/gloves and frequency of hand washing
4. Describe sources and modes for transmission of infection
5. Describe institutional/departmental procedures for infection control
6. Discuss psychological consideration for management of infectious patients

VI. Asepsis

A. Definitions
1. Asepsis
2. Antiseptic/disinfectant
3. Sterile/clean
4. Sterile area/contaminated area
5. Endogeneous infections/ectogeneous infections
6. Other

B. Common Antiseptics

C. Methods of Sterilization
1. Autoclave
2. Dry heat
3. Chemical
4. Gas

D. Considerations
1. Procedures
   - -Scrub
   - -Gown
   - -Glove
   - -Instruments
2. Sterile areas
3. Other

E. Care of wounds
1. Cleansing
2. Dressing

Objectives:

1. Define
   - -Asepsis
   - -Antiseptic/disinfectant
   - -Sterile/clean
   - -Sterile area/contaminated area
   - -Endogeneous infections/ectogeneous infections
2. List common antiseptics
3. Describe methods of sterilization
4. Discuss the following procedures
   - -Scrubbing
   - -Gowning and gloves
   - -Handling of instruments
   - -Maintenance of sterile area
5. Explain principles for care of wounds

VII. Contrast Media

A. Definitions
1. Radiolucent
   - -Air
   - -Gases

2. Radiopaque
   - -Barium compounds
   - -Aqueous iodine compounds
   - -Oily iodine compounds
   - -Other

B. Pharmacology

1. Barium compounds
   - -Patient history/allergy
   - -Chemical composition
   - -Patient precautions
   - -Patient reactions
   - -Emergency care
2. Iodine compounds
   - -Patient history/allergy
   - -Chemical composition
   - -Patient precautions
   - -Patient reactions
   - -Emergency care
3. Other

C. Methods of Administration

1. Systemic
   - -Oral
   - -Rectal
   - -Tube/catheter
   - -Inhalation
2. Parenteral
   - -Intravenous
   - -Intra-arterial
   - -Intraspinal

D. Administration Techniques

1. Oral
   - -Spoon
   - -Cup
   - -Capsule
   - -Other
2. Tube/Castheter
   - -Nasogastric
   - -Urinary
   - -Enema
   - -Other

3. Intravenous*
   - -Syringe/needle
   - -Infusion container/catheter/needle

Objectives:

1. Define the categories of contrast media and give specific examples for each category

2. Discuss the pharmacology of barium compounds in regard to
   - -Patient history/allergy
   - -Chemical composition
   - -Patient precautions
   - -Patient reactions
   - -Emergency care

3. Discuss the pharmacology of iodine compounds in regard to
   - -Patient history/allergy
   - -Chemical composition
   - -Patient precautions
   - -Patient reactions
   - -Emergency care

4. Describe methods of administering contrast media and discuss administration techniques for each method

*In states and/or institutions where it is a standard practice for the radiographer to perform injections, this technique must be taught. Where this subject area is included in the curriculum, the Program has specific ethical and legal responsibilities to the patient and student. The student shall be assured that:

- Legal statutes allow performance of this procedure by radiographers
- Professional liability coverage is adequate
- Adequate supervision is provided
- Appropriate, structured, laboratory objectives are identified
- Evaluation and demonstration of total competency occurs before this task is performed unsupervised

VIII. Patient Education

A. Communication

1. Definition
2. Methods
   - -Language
   - -Written word
   - -Pictures
   - -Signs/gestures

B. Patient Communication Problems

1. Inability to understand English
2. Aphasic
3. Deafness
4. Blindness
5. Age
6. Physical condition
7. Mental condition
8. Other

C. Explanation of Examinations

1. Confirm identity of patient
2. Assess patient's level of comprehension
3. Elements of explanation
   - -Greeting
   - -Establish rapport
   - -Describe examination to be performed
   - -Provide instructions
   - -Respond to questions
   - -Initiate examination

D. Radiation Safety/Protection

Objectives:

1. Define communication
2. Identify methods of communication and discuss how each can be utilized in patient education
3. Identify patient communication problems and discuss how each can be overcome to provide patient education
4. Given clinical simulations, demonstrate explanations of radiographic examinations
5. Given clinical simulations, demonstrate explanations for patients with various communication problems

6. Discuss radiation safety and protection questions patients might ask in connection with radiologic examinations and the radiographer response to each

IX. Interacting with the Terminally Ill

A. Understanding the Process of Dying
1. Patient
2. Professional

B. Aspects of Death
1. Ethical components
   - -Suicide
   - -Euthanasia
2. Emotional
   - -Religious
   - -Cultural
3. Physical
   - -Pain
   - -Suffering
   - -Disability
   - -Deterioration

C. Stages of Dying
1. Rejection
2. Denial
3. Anger
4. Bargaining
5. Acceptance

D. Aspects of Patient Support
1. Family/friends
2. Pastoral care
3. Patient to patient service groups
4. Psychological support groups
5. Hospice
6. Health professionals
7. Other

Objectives:

1. Discuss how the patient and the professional understand the process of dying

2. Discuss ethical, emotional and physical aspects of death

3. List the stages of dying and describe the characteristics of each stage

4. Identify support available to the terminally ill from various sources

METHODS OF PATIENT CARE

1. Collins; Communication in Health Care, 1977, C.V. Mosby Company

2. DuGas; Introduction to Patient Care, 2nd Edition, 1972, W.B. Saunders

3. Ehrlich/Givens; Patient Care in Radiography, 1981, C.V. Mosby Company

4. Purtilo; Health Professional/Patient Interaction, 1978, W.B. Saunders

5. Torres/Moore; Basic Medical Techniques and Patient Care for Radiologic Technologist, 1978, J.B. Lippincott Company

HUMAN STRUCTURE AND FUNCTION

This unit will provide the student with knowledge of the structure and function of the human body. Cells, tissues and bones will be described. Organs will be discussed as components of their respective systems.

I. **Anatomical Nomenclature**

II. **Cells**

III. **Tissues**

IV. **Body Cavities**

V. **Bone**

VI. **Articulations**

VII. **Skeletal System**

VIII. **Muscular System**

IX. **Digestive System**

X. **Respiratory System**

XI. **Urinary System**

XII. **Reproductive System**

XIII. **Circulatory System**

XIV. **Reticuloendothelial System**

XV. **Endocrine System**

XVI. **Nervous System**

XVII. **Special Senses**

XVIII. **Transverse Anatomy**

IXX. **Topographic Anatomy**

HUMAN STRUCTURE AND FUNCTION

I. Anatomical Nomenclature

A. Terms of Direction
1. Anterior/posterior
2. Ventral/dorsal
3. Medial/lateral
4. Superior/inferior
5. Proximal/distal
6. Cephalad/caudad
7. Other

B. Body Planes
1. Median/mid-sagittal
2. Saggital
3. Coronal
4. Transverse
5. Longitudinal
6. Other

Objectives:

1. Given frontal and lateral diagrams of the human body, label components to identify terms of direction

2. Given frontal and lateral diagrams of the human body, draw and label various body planes

II. Cells

A. Structure
1. Nucleus
2. Cytoplasm

B. Function/Reproduction
1. Interphase
   - -Protein synthesis
   - -Cell differentiation
2. Mitosis
   - -Prophase
   - -Metaphase
   - -Anaphase
   - -Telophase
3. Meiosis

C. Aberrations

HUMAN STRUCTURE AND FUNCTION

Objectives:

1. Identify structural characteristics of a basic cell
2. Identify the nucleus and its contents
3. Identify the cytoplasm and its contents
4. Describe the process of protein synthesis
5. Describe the process of cell differentiation
6. Differentiate between mitosis and meiosis
7. List and describe the stages of mitosis in order of occurrance

III. Tissues

A. Embryonic Layers

B. Structure and Function
1. Epithelial
2. Connective
3. Muscle
4. Nerve

C. Body Membranes
1. Mucous
2. Serous
3. Synovial
4. Cutaneous
5. Other

Objectives:

1. Identify the germinal layers of the embryo
2. List and provide a location for each of the tissue classifications
3. Compare and contrast structural and functional characteristics of each of the tissue classifications
4. Describe the following tissue types
   - -Epithelial
   - -Connective
   - -Muscle
   - -Nerve
5. Name and locate types of body membranes

IV. Body Cavities

A. Thoracic
1. Structural limits
2. Function
3. Contents

B. Abdominal
1. Structural limits
2. Function
3. Contents

C. Pelvis
1. Structural limits
2. Function
3. Contents

Objectives:

1. Discuss the thoracic cavity in terms of structural limits, function and contents
2. Discuss the abdominal cavity in terms of structural limits, function and contents
3. Discuss the pelvic cavity in terms of structural limits, function and contents

V. Bone

A. Formation
1. Intramembraneous ossification
2. Endochondral ossification

B. Structure
1. Medullary cavity/marrow
2. Compact bone
3. Cancellous bone
4. Periosteum
5. Cartilage
   - -Hyaline
   - -Fibrous
   - -Elastic

C. Growth
1. Physis
2. Diaphysis
3. Epiphysis/epiphyseal line
4. Metaphysis

D. Classification
1. Long
2. Short
3. Flat
4. Irregular

E. Markings
1. Processes/projections
   - -Condyle
   - -Head
   - -Trochanter
   - -Crest
   - -Spine
   - -Tuberosity
   - -Tubercle
   - -Other
2. Depressions/openings
   - -Fossa
   - -Sinus
   - -Foramen
   - -Meatus
   - -Other

Objectives:

1. Compare and discuss intramembraneous and endochondral ossification
2. Given diagrams of bones, identify various components and structures
3. Given radiographs of children, identify the structures visualized and explain the process of bone growth
4. Given radiographs, identify and locate various classifications of bone
5. Given skeletal parts and radiographs, locate and identify bony processes and depressions

VI. Articulations

A. Definition

B. Function

C. Structure
1. Joint capsule
2. Articular surface
3. Articular cartilage
4. Synovial membrane
5. Synovial fluid
6. Ligaments

D. Synarthrosis
1. Definition
2. Types
   - -Fibrous
   - -Cartilaginous
3. Locations

E. Amphiarthrosis
1. Definition
2. Types
   - -Fibrocartilaginous
3. Locations
4. Movement
   - -Limited

F. Diarthrosis
1. Definition
2. Types
   - -Ball and socket
   - -Hinge
   - -Pivot
   - -Ellipsoidal/condyloid
   - -Saddle
   - -Gliding
3. Locations
4. Movements
   - -Flexion
   - -Extension
   - -Abduction
   - -Adduction
   - -Rotation
   - -Circumduction
   - -Inversion
   - -Eversion
   - -Special

Objectives:

1. Define articulation
2. Given articulation diagrams, locate and label the component parts
3. Compare and discuss synarthrotic, amphiarthrotic and diarthrotic articulations including definitions, types, locations within the body and movements

VII. Skeletal System

A. Axial
1. Skull
   - -Cranium
   - -Facial bones
   - -Auditory ossicles

2. Hyoid bone
3. Vertebral column
4. Thorax

B. Appendicular
1. Pectoral girdle
2. Upper extremities
3. Pelvic girdle
4. Lower extremities

C. Sesamoids
1. Definition
2. Common sites

D. Functions
1. Support
2. Protection
3. Movement
4. Hemopoiesis

Objectives:

1. Given radiographs, diagrams and skeletal parts, identify and locate the bones of the axial skeleton
2. Describe processes and depressions found on bones of the axial skeleton
3. Describe articulations of the axial skeleton
4. Given radiographs, diagrams and a skull, locate and identify sutures of the skull
5. Given radiographs, diagrams and a skeleton, identify and discuss primary and secondary curves of the spine
6. Given radiographs, diagrams and skeletal parts, identify and locate the bones of the appendicular skeleton
7. Given radiographs, diagrams and skeletal parts, describe projections and depressions found on bones of the appendicular skeleton
8. Define sesamoids and locate examples on radiographs
9. Discuss the functions of the skeletal system

VIII. Muscular System

A. Functions
1. Movement
2. Posture
3. Heat production

B. Types

1. Skeletal/striated
   - -Characteristics
   - -Function
2. Smooth
   - -Characteristics
   - -Function
3. Cardiac
   - -Characteristsics
   - -Function

Objectives:

1. Describe the functions of muscles
2. Discuss types of muscles including the characteristics and function of each type

IX. Digestive System

A. Mouth

1. Palates
   - -Hard
   - -Soft
2. Teeth
   - -Deciduous/permanent
   - -Names
   - -Structure/location
   - -Function
3. Tongue
   - -Structure
   - -Functions
4. Salivary glands
   - -Structure
   - -Locations
   - -Functions

B. Primary Organs

1. Esophagus
   - -Structure/location
   - -Functions
2. Stomach
   - -Structure/location
   - -Functions
3. Small intestine
   - -Structure/location
   - -Functions
4. Large intestine
   - -Structure/location
   - -Functions

5. Rectum
   - -Structure/location
   - -Functions
6. Anal canal/anus
   - -Structure/location
   - -Function

C. Accesory Organs

1. Pancreas
   - -Structure/location
   - -Secretions
   - -Functions
2. Liver
   - -Structure/location
   - -Secretions
   - -Functions
3. Gallbladder
   - -Structure/location
   - -Functions

D. Digestion

1. Definition
2. Purpose
3. Digestive changes
   - -Mechanical
   - -Chemical
4. Absorption

Objectives:

1. Describe the hard and soft palates
2. Discuss deciduous and permanent teeth in terms of age for eruption and number
3. Discuss types of teeth in terms of number, location within the jaws and function
4. Given cross-sectional diagrams of teeth, label the component parts
5. Describe the tongue in terms of structure and functions
6. Describe the salivary glands in terms of structure, locations and functions
7. List the primary organs of the digestive system
8. Given diagrams and radiographs of primary organs comprising the digestive system, label the parts

9. Describe the layers of tissue that comprise the esophagus, stomach, small intestine, large intestine and rectum

10. Explain the functions of each primary organ of the digestive system

11. Differentiate from peritoneum, omentum and mesentery

12. List the accessory organs of the digestive system

13. Given diagrams and radiographs of accessory organs of the digestive system, label the parts

14. Discuss the secretions of accessory organs of the digestive system and the function of each

15. Discuss the functions of the accessory organs of the digestive system

16. Explain the purpose of digestion

17. Discuss types of digestive changes that occur in the body

18. Explain the process of absorption that occurs during digestion

X. Respiratory System

A. Nose/Nasal Cavity
1. Structure
2. Functions

B. Paranasal Sinuses
1. Structure/locations
2. Functions

C. Pharynx
1. Structure/location
2. Functions

D. Larynx
1. Structure/location
2. Functions

E. Trachea
1. Structure/location
2. Functions

F. Bronchi
1. Structure/location
2. Functions

G. Lungs
1. Structure/location
2. Functions

H. Respiration
1. Definition
2. Pulmonary ventilation
3. Alveolar gas exchange
4. Transport of blood gases
5. Tissue gas exchange
6. Regualation

Objectives:

1. Given diagrams and radiographs of components of the respiratory system, label the parts
2. Define respiration
3. Explain pulmonary ventilation
4. Discuss alveolar exchange
5. Describe the transport of blood gases
6. Explain tissue gas exchange
7. Describe how respiration is regulated

XI. Urinary System

A. Organs
1. Kidneys
   -Structure/location
   -Functions
2. Ureters
   -Structure/location
   -Functions
3. Bladder
   -Structure/location
   -Functions
4. Male Urethra
   -Structure/location
   -Functions
5. Female Urethra
   -Structure/location
   -Functions

B. Urine
   1. Composition
   2. Formation

C. Micturition

Objectives:

1. Given diagrams and radiographs, label parts of the kidneys, ureters, bladder and urethra
2. Explain the function of each organ of the urinary system
3. Describe the composition of urine
4. Discuss how urine is formed
5. Explain micturition

XII. Reproductive System

A. Male

1. Testes
   - -Structure/location
   - -Functions
2. Internal accessory organs
   - -Structure/location
   - -Functions
3. External organs
   - -Structure/location
   - -Functions
4. Reproduction
   - -Definition
   - -Spermatogenesis
   - -Coitus

B. Female

1. Ovaries
   - -Structure/location
   - -Functions
2. Internal accessory organs
   - -Structure/location
   - -Functions
3. External organs
   - -Structure/location
   - -Functions

4. Mammary glands
   - -Structure/location
   - -Functions
   - -Lactation
5. Sexual Cycles
   - -Ovarian
   - -Menstrual
   - -Other
6. Reproduction
   - -Definition
   - -Ovulation
   - -Insemination
   - -Fertilization
   - -Segmentation
   - -Histogenesis

Objectives:

1. Given diagrams of the male reproductive system, label the part
2. Describe the role of the male in reproduction
3. Given diagrams and radiographs of the female reproductive system, label the parts
4. Explain lactation
5. Discuss female sexual cycles
6. Describe the role of the female in reproduction

XIII. Circulatory System

A. Hemopoietic

1. Heart
   - -Structure
   - -Function
2. Blood vessels
   - -Types
   - -Structure
   - -Function
3. Blood
   - -Composition
   - -Types
   - -Function
   - -Pressure

4. Circulation
   - -Pulmonary
   - -Systemic
   - -Fetal

B. Lymphatic

1. Lymphatics
   - -Structure
   - -Function
2. Lymph nodes
   - -Structure
   - -Function
3. Lymph organs
   - -Structure
   - -Function
4. Lymph
   - -Compostion
   - -Function
5. Circulation

Objectives:

1. Given a diagram of the heart, label its parts
2. Describe the function of the heart
3. Describe the structure and function of arteries, veins and capillaries
4. Trace the flow of blood through the body
5. Discuss pulmonary, systemic and fetal circulation
6. Identify components of blood and describe the purpose of each component
7. List blood types
8. Explain blood pressure
9. Explain functions of blood
10. List components of the lymphatic system and describe the function of each component
11. Describe the composition and function of lymph

XIV. Reticuloendothelial System

A. Function

B. Reticuloendothelium
1. Liver
2. Spleen
3. Bone marrow
4. Lymph node lining

C. Macrophages
1. Function

Objectives:

1. Explain the function of the reticuloendothelial system
2. Name and locate reticuloendothelium
3. Describe the function of macrophages

XV. Endocrine System

A. Definition

B. General Action

C. Pituitary Gland/Hypophysis Cerebri
1. Location
2. Structure
3. Hormones
4. Function

D. Thyroid Gland
1. Location
2. Structure
3. Hormones
4. Function

E. Parathyroid Glands
1. Location
2. Structure
3. Hormone
4. Function

F. Adrenal Glands/Suprarenals
1. Location
2. Structure
3. Hormones
4. Function

G. Islands of Langerhans
1. Location
2. Structure
3. Hormone
4. Function

H. Ovaries
1. Location
2. Structure
3. Hormones
4. Functions

I. Testes
1. Location
2. Structure
3. Hormones
4. Functions

J. Pineal Gland/Pineal Body
1. Location
2. Structure
3. Hormone
4. Function

K. Placenta
1. Location
2. Structure
3. Hormones
4. Function

Objectives:

1. Define endocrine
2. Describe the general action of the endocrine system
3. Identify the location and describe the structure of each component of the endocrine system
4. Identify the major hormone(s) secreted by each component of the endocrine system
5. Explain the function of each component of the endocrine system

XVI. Nervous System

A. Types of Nerve Cells
1. Afferent neurons
   - -Structure
   - -Function
2. Efferent neurons
   - -Structure
   - -Function

B. Nerve Impulse
1. Stimulus
2. Receptor
3. Response

C. Brain
1. Structure
   - -Cerebrum
   - -Cerebellum
   - -Brain stem
2. Functions

D. Meninges
1. Components
   - -Dura mater
   - -Arachnoid
   - -Pia mater
2. Structure
3. Function

E. Cerebrospinal Fluid
1. Formation
2. Circulation
3. Function

F. Spinal Cord
1. Structure
2. Function

G. Cranial Nerves
1. Distribution
2. Function

H. Spinal Nerves
1. Distribution
2. Function

I. Autonomic Nervous System
1. Sympathetic
   - -Structure
   - -Function

2. Parasympathetic
   -Structure
   -Function

Objectives:

1. Describe the structure and function of types of nerve cells
2. Describe the structure of the brain and the relationship of its component parts
3. Discuss brain functions
4. List the meninges, describe and discuss the function of each
5. Discuss the formation, circulation and function of cerebrospinal fluid
6. Describe the structure and discuss the function of the spinal cord
7. Discuss the distribution and function of cranial nerves
8. Discuss the distribution and function of spinal nerves
9. Discuss the structure and function of components of the autonomic nervous system

XVII. Special Senses

A. Sight
1. Component
2. Structure

B. Hearing/Equilibrium
1. Components
   -External ear
   -Middle ear
   -Inner ear
   -Eustachian tubes
2. Structure

C. Smell
1. Components
2. Structure

D. Taste
1. Components
2. Structure

E. Somatic
1. Touch/pressure
2. Temperature
3. Pain

Objectives:

1. Describe the structure of the eye
2. Given diagrams, identify and locate components of the
   -External ear
   -Middle ear
   -Inner ear
   -Eustachian tubes
3. Describe the structure of the components of the ear
4. Describe the components and structure of body parts involved in the sense of smell
5. Describe the components and structure of body parts involved in the sense of taste
6. List somatic senses

XVI-
II. Transverse Anatomy

A. Skull
1. Structures/locations
2. Imaging applications
   -Computed tomography
   -Other imaging modalities

B. Thorax
1. Structures/locations
2. Imaging applications
   -Computed tomography
   -Other imaging modalities

C. Abdomen/Pelvis
1. Structures/locations
2. Imaging applications
   -Computed tomography
   -Other imaging modalities

HUMAN STRUCTURE AND FUNCTION

Objectives:

1. Given diagrams and computed tomography scans of the head, label structures demonstrated
2. Given diagrams and computed tomography scans of the thorax, label structures demonstrated
3. Given diagrams and computed tomography scans of the abdomen/pelvis, label structures demonstrated
4. Identify imaging modalities that utilize transverse anatomy

XIX. Topographic Anatomy

A. Head
1. Landmarks
2. Underlying anatomy

B. Neck
1. Landmarks
2. Underlying anatomy

C. Thorax
1. Landmarks
2. Underlying anatomy

D. Abdomen
1. Landmarks
2. Underlying anatomy

E. Pelvis
1. Landmarks
2. Underlying anatomy

F. Spine
1. Landmarks
2. Underlying anatomy

G. Upper Extremities
1. Landmarks
2. Underlying anatomy

H. Lower Extremities
1. Landmarks
2. Underlying anatomy

Objective:

1. Given phantoms and human subjects, identify topographical landmarks for various body areas

HUMAN STRUCTURE AND FUNCTION

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6. Kimber/Gray/Stackpole/Leavell; Textbook of Anatomy and Physiology, 1955, MacMillan

7. Meschan; An Atlas of Normal Radiographic Anatomy, 2nd Edition, 1959, W.B. Saunders

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RADIOGRAPHIC PROCEDURES

This unit will provide the student with the knowledge to perform radiographic procedures. Considerations related to the production of quality radiographs will be discussed. Special studies will be described. Laboratory materials should be utilized to demonstrate clinical applications of theoretical principles and concepts.

I. **Introduction to Radiographic Procedures**

II. **General Considerations**

III. **Positioning Considerations**

IV. **Procedures Related to Body Cavities**

V. **Procedures Related to the Skeletal System**

VI. **Procedures Related to the Digestive System**

VII. **Procedures Related to the Respiratory System**

VIII. **Procedures Related to the Urinary System**

IX. **Procedures Related to the Reproductive System**

X. **Procedures Related to the Circulatory System**

XI. **Procedures Related to the Nervous System**

XII. **Procedures Related to the Special Senses**

XIII. **Special Studies**

RADIOGRAPHIC PROCEDURES

I. Introduction to Radiologic Procedures

A. Positioning Nomenclature

1. Radiographic terms
   - -View
   - -Position
   - -Projection
2. Terms of position
   - -Erect
   - -Recumbent
   - -Supine
   - -Prone
   - -Trendelenburg
   - -Decubitus
   - -Other

B. Positioning Aids

1. Sponges
   - -Description
   - -Applications
   - -Advantages/disadvantages
2. Sandbags
   - -Description
   - -Application
   - -Advantages/disadvantages
3. Compression bands
   - -Description
   - -Applications
   - -Advantages/Disadvantages
4. Restraining bands
   - -Description
   - -Applications
   - -Advantages/disadvantages
5. Film holders
   - -Description
   - -Applications
   - -Advantages/disadvantages
6. Other

C. Accessory Equipment

1. Calipers
   - -Function
   - -Operation
2. Lead strips
   - -Function
   - -Applications
3. Lead aprons/gloves
   - -Functions
   - -Applications
4. Gonadal shields
   - -Functions
   - -Applications

5. Shadow shields
   -Function
   -Applications
6. Lead markers
   -Function
   -Types
   -Applications
7. Other

Objectives:

1. Define the following radiographic terms
   -View - defines the body part as seen by an x-ray film or other recording media. Restricted to the discussion of a radiograph or image.
   -Position - refers to a specific body position, such as supine, prone, recumbent, erect or Trendelenberg. Restricted to the discussion of the patient's physical position.
   -Projection - restricted to the discussion of the path of the central ray.
2. Define various terms of position
3. Describe various positioning aids and discuss the application and advantages/ disadvantages of each
4. Describe various accessory equipment and discuss each in terms of function and application
5. Demonstrate the operation of calipers
6. Discuss lead markers in terms of function, types and application

II. General Considerations

A. Evaluation of Radiographic Orders

1. Patient identification
2. Verification of procedure(s) ordered
   -Clinical history
   -Patient symptoms

B. Establish Patient Rapport

1. Patient status evaluation
   -Cooperative/uncooperative
   -Trauma
   -Geriatric
   -Other
2. Explain procedure(s)

C. Patient Pregnancy

D. Patient Preparation

1. Dietary
   -Verification

2. Medication
   -Verification
3. Disrobing
4. Potential artifacts
5. Other

E. Room Preparation
1. Appearance/cleanliness
2. Equipment/supplies
   -Standard
   -Fluoroscopic set-up
   -Contrast medium requirement
   -Special
3. Other

F. Patient Assistance

G. Patient Monitoring
1. Infants/children
2. Adults
   -Geriatric
   -Comatose
   -Disoriented
   -Other

H. Evaluation of Radiographs/Patient Dismissal
1. In patients
2. Out patients
   -Ambulatory
   -Trauma/acute illness
3. Immediate reports

I. Other

Objectives:

1. Discuss general considerations for radiographic procedures

2. Given clinical simulations for various radiographic procedures, explain the general considerations involved

3. Through role playing, demonstrate general considerations involved with various radiographic procedures

III. Positioning Considerations*

* It is understood that appropriate Positioning Considerations are a component of instruction for each view in the systems that follow.

A. Part
1. Position
2. Structure(s) visualized/function(s) demonstrated

B. Film Size/Placement

C. Technique Formation/Selection

D. Beam Alignment/Angulation

E. Beam Limitation/Shielding

F. Patient Instructions
1. Respiration
2. Other

G. Special Considerations
1. Mobile unit procedures
2. Surgical procedures
3. Other

H. Other

Objectives:

1. Discuss positioning considerations for radiographic procedures

2. Given clinical simulations for various radiographic procedures, explain the positioning considerations involved

3. Through role playing, demonstrate positioning considerations involved with various radiographic procedures

IV. Procedures Related to Body Cavities

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of body cavities in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of body cavities, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to body cavities

4. Given radiographs of body cavities, evaluate in terms of positioning accuracy and image quality

V. Procedures Related to the Skeletal System

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of the skeletal system in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of the skeletal system, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to the skeletal system

4. Given radiographs of various parts of the skeletal system, evaluate in terms of positioning accuracy and image quality

VI. Procedures Related to the Digestive System

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of the digestive system in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of the digestive system, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to the digestive system

4. Given radiographs of various parts of the digestive system, evaluate in terms of positioning accuracy and image quality

VII. Procedures Related to the Respiratory System

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of the respiratory system in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of the respiratory system, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to the respiratory system

4. Given radiographs of various parts of the respiratory system, evaluate in terms of positioning accuracy and image quality

VIII. Procedures Related to the Urinary System

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of the urinary system in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of the urinary system, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to the urinary system

4. Given radiographs of various parts of the urinary system, evaluate in terms of positioning accuracy and image quality

IX. Procedures Related to the Reproductive System

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of the reproductive system in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of the reproductive system, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to the reproductive system

4. Given radiographs of various parts of the reproductive system, evaluate in terms of positioning accuracy and image quality

X. Procedures Related to the Circulatory System

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of the circulatory system in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of the circulatory system, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to the circulatory system

4. Given radiographs of various parts of the circulatory system, evaluate in terms of positioning accuracy and image quality

XI. Procedures Related to the Nervous System

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of the nervous system in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of the nervous system, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to the nervous system

4. Given radiographs of various parts of the nervous system, evaluate in terms of positioning accuracy and image quality

XII. Procedures Related to the Special Senses

A. Routine Views

B. Special Views

Objectives:

1. Describe routine and special views of organs and parts related to special senses in terms of structure(s) visualized/function(s) demonstrated, general and positioning considerations

2. Given clinical simulations for routine and special views of organs and parts related to special senses, explain the structure(s) visualized/function(s) demonstrated, general and positioning considerations involved

3. In a laboratory environment, perform radiographic procedures related to special sense organs and parts

4. Given radiographs of organs and parts related to special senses, evaluate in terms of positioning accuracy and image quality

XIII. Special Studies

A. Equipment/Materials Utilized
1. Imaging
2. Other

B. Systems
1. Skeletal
2. Digestive
3. Respiratory
4. Urinary
5. Reproductive
6. Circulatory
7. Endocrine
8. Nervous
9. Special senses

C. Contrast Medium
1. Type
2. Administration method
3. Quantity

D. Procedure
1. General description
2. Patient care considerations
3. Positioning considerations
4. Views

F. Structure(s) Visualized/Function(s) Demonstrated

Objectives:

1. Discuss imaging and other equipment and supplies used in various special studies

2. Describe special studies performed on parts of various systems

3. Given various special studies, describe the contrast medium utilized for each study in terms of type, administration method and quantity

4. Describe the patient preparation for various special studies

5. Discuss various special studies in terms of general description, patient care considerations, positioning considerations and views

6. Given various special study images, identify the specific structure(s) visualized and function(s) demonstrated

RADIOGRAPHIC PROCEDURES

1. Ballinger; Merrill's Atlas of Radiographic Positions and Radiologic Procedures, 5th Edition, 1982, C.V. Mosby Company

2. Bontrager/Anthony; Textbook of Radiographic Positioning and Related Anatomy, 1982, Multi-Media Publishing Company

3. Clark; Positioning in Radiography, 9th Edition, Yearbook Medical Publishers

4. Meschan; Radiographic Positioning and Related Anatomy, 2nd Edition, 1978, W.B. Saunders

5. Snopek; Fundamentals of Special Radiographic Procedures, 1975, McGraw Hill, Inc.

6. Tortorici; Fundamentals of Angiography, 1982, C.V. Mosby Company

PRINCIPLES OF RADIOGRAPHIC EXPOSURE

This unit will provide the student with the knowledge of factors that govern and influence the production of the radiographic image on radiographic film. Laboratory materials should be utilized to demonstrate clinical applications of the theoretical principles and concepts.

I. **Radiographic Density**

II. **Radiographic Contrast**

III. **Recorded Detail**

IV. **Distortion**

V. **Exposure Latitude**

VI. **Beam Limiting Devices**

VII. **Beam Filtration**

VIII. **Scattered/Secondary Radiation**

IX. **Control of the Remnant Beam**

X. **Technique Formation**

XI. **Exposure Calculations**

PRINCIPLES OF RADIOGRAPHIC EXPOSURE

I. Radiographic Density

A. Definition

B. Acceptable Range

C. Factors

1. mAs
2. kVp
3. Distance
4. Intensifying screens
5. Grids
6. Beam limitation
7. Patient considerations
8. Processing
9. Contrast media
10. Compensatory filtration
11. Heel effect

Objectives:

1. Define radiographic density
2. Identify the acceptable range of radiographic density
3. Analyze relationships of factors affecting radiographic density

II. Radiographic Contrast

A. Definition

B. Components

1. Subject
2. Film

C. Factors

1. kVp
2. Scattered radiation
3. Grids
4. Beam limitation
5. Intensifying screens
6. Patient considerations
7. Distance
8. Processing
9. Fog
10. Contrast media

PRINCIPLES OF RADIOGRAPHIC EXPOSURE

Objectives:

1. Define radiographic contrast
2. Differentiate between subject contrast and film contrast
3. Analyze relationships of factors affecting radiographic contrast

III. Recorded Detail

A. Definition

B. Components
1. Umbra
2. Penumbra

C. Factors
1. Geometric
   - -Focal film distance
   - -Object film distance
   - -Focal spot
2. Unsharpness
   - -Motion
   - -Intensifying screens

Objectives:

1. Define recorded detail
2. Differentiate between umbra and penumbra
3. Analyze relationships of factors affecting recorded detail

IV. Distortion

A. Definition

B. Types
1. Shape
2. Size

C. Factors
1. Distance
2. Tube/Part/Film relationships

PRINCIPLES OF RADIOGRAPHIC EXPOSURE

Objectives:

1. Define distortion
2. Differentiate between shape distortion and size distortion
3. Analyze relationships of factors affecting distortion

V. Exposure Latitude

A. Definition

B. Factors

1. kVp
2. Intensifying screens
3. Film

Objectives:

1. Define exposure latitude
2. Analyze relationships of factors affecting exposure latitude

VI. Beam Limiting Devices

A. Definition

B. Purposes

C. Types

1. Collimators
   - -Function
   - -Applications
2. Apertures/Diaphragms
   - -Function
   - -Applications
3. Cones
   - -Function
   - -Applications
4. Positive beam limitation (PBL)
   - -Function
   - -Applications

Objectives:

1. Define beam limiting device
2. Explain purposes of beam limiting devices in terms of patient dosage, scattered radiation production, radiographic density and contrast
3. Describe types of beam limiting devices in terms of function and applications

VII. Beam Filtration

A. Definition

B. Rationale

C. Composition

D. Types
1. Inherent
2. Additional
3. Total
4. Compensatory
   -Applications

E. Half value layer
1. Definition
2. Application

Objectives:

1. Define filtration
2. Describe the rationale for filtration of the primary beam
3. Describe metals used for beam filtration
4. Explain types of filtration in terms of radiation output, patient dosage, radiation density and contrast
5. Define half value layer and describe its application in terms of radiation output and patient dosage

VIII. Scattered/Secondary Radiation

A. Definition

B. Interactions

C. Factors
1. kVp
2. Patient considerations
3. Beam limitation
4. Grids
5. Distance
6. Contrast media

D. Effects
1. Patient dosage
2. Image quality
3. Occupational exposure

Objectives:

1. Define scattered/secondary radiation
2. Describe interactions of x-rays with matter which produce scattered/secondary radiation
3. Analyze relationships of factors affecting scattered/secondary radiation
4. Discuss effects of scattered/secondary radiation in terms of patient dosage, image quality and occupational exposure

IX. Control of the Remnant Beam

A. kVp Selection

B. Grids
1. Purpose
2. Components
3. Construction

4. Types
    - -Linear
    - -Parallel
    - -Focused
    - -Rhombic
    - -Cross hatch
    - -Stationary
    - -Moving
5. Efficiency
    - -Ratio
    - -Frequency
6. Selection
    - -kVp
    - -Patient considerations
    - -Distance
    - -Beam alignment
    - -Latitude
7. Cut off
    - -Definition
    - -Factors
8. Artifacts

C. Beam Limitation

Objectives:

1. Explain the relationship between kVp and scattered/secondary radiation
2. Describe a grid in terms of its purpose, components and construction
3. Differentiate among types of grids
4. Analyze grid efficiency in terms of grid ratio and frequency
5. Given technical information, select an appropriate grid
6. Define grid cut off
7. Describe factors influencing grid cut off
8. Describe various grid artifacts
9. Explain the relationship between beam limitation and scattered/ secondary radiation

X. Technique Formation

A. Purpose
1. Standardization of exposure
2. Image consistency

B. Considerations
1. Choice of technique system
2. Patient measurement
3. Processing

C. Types
1. Optimum kVp/variable mAs
2. Variable kVp/fixed mAs
3. Automated exposure
4. Other

D. Application

Objectives:

1. Explain the purpose of technique formation in terms of standardization of exposure and image consistency

2. Discuss considerations involved in technique selection

3. Distinguish among various types of technique systems

4. Given clinical simulations, demonstrate patient measurement and technique selection

XI. Exposure Calculations

A. Factors
1. Distance
2. mAs
3. kVp
4. Grids
5. Intensifying screens
6. Film
7. Focal spots

B. Calculations
1. Density
   -Photographic effect
2. Penumbra

3. Distortion
   - -Magnification factor
   - -Percent magnification
4. Contrast
   - -Average gradient
5. mAs reciprocity

Objectives:

1. Analyze relationships of factors affecting exposure calculations.
2. Given technical factors, calculate the photographic effect
3. Given technical problems, calculate penumbra, magnification factor, percent magnification and average gradient
4. Apply mAs reciprocity to clinical simulations

PRINCIPLES OF RADIOGRAPHIC EXPOSURE

1. Bushong; Radiologic Science for Technologists, 2nd Edition, 1980, C.V. Mosby Company

2. Christensen/Curry/Dowdey; An Introduction to the Physics of Diagnostic Radiology, 2nd Edition, 1978, Lea Febiger

3. Cullinan/Cullinan; Illustrated Guide to X-Ray Technics, 2nd Edition, 1980, J.B. Lippincott Company

4. Gurley/Callaway/etal; Introduction to Radiologic Technology, 1982, Multi-Media Publishing Company

5. Hiss; Understanding Radiography, 1978, Charles C. Thomas

6. Selman; The Fundamentals of X-Ray and Radium Physics, 6th Edition, 1977, Charles C. Thomas

7. Sprawls; The Physical Principles of Diagnostic Radiology, 1977, University Park Press

IMAGING EQUIPMENT

This unit will provide the student with knowledge of equipment routinely utilized to produce diagnostic images. Various recording media and techniques are discussed. Other imaging equipment is described.

I. **Radiographic Equipment**

II. **Image Intensified Fluoroscopy**

III. **Recording Media and Techniques**

IV. **Image Noise**

V. **Other Imaging Equipment**

IMAGING EQUIPMENT

I. Radiographic Equipment

A. Permanent Installation
1. Purpose
2. Components
3. Types
4. Applications

B. Mobile Units
1. Purpose
2. Components
3. Types
4. Applications

Objectives:

1. Discuss permanent installation radiographic equipment in terms of purpose, components, types and applications

2. Demonstrate operation of various types of permanent installation radiographic equipment

3. Discuss mobile units in terms of purpose, components, types and applications

4. Demonstrate operation of various types of mobile unit radiographic equipment

II. Image Intensified Fluoroscopy

A. Definition

B. Components
1. Input phosphor
2. Photo cathode
3. Electron lens
4. Output phosphor

C. Function

D. Intensification
1. Gain
2. Conversion factor

E. Optical System
1. Collimating lens
2. Beam splitter

3. Aperture
4. Camera lens

F. Image Formation
1. Image size and framing
2. Image brightness (exposure)

G. Applications

H. Operation/Technique*

Objectives:

1. Define image intensified fluoroscopy
2. Diagram the components of an image intensifier
3. Explain the function of an image intensifier
4. Discuss gain and conversion factor as related to intensification

* In 1981, the American Society of Radiologic Technologists Board of Directors adopted the following position statement:

> "The American Society of Radiologic Technologists does not endorse the performance of interpretive fluoroscopy on human beings by non-physicians. Radiographers properly educated in the safe operation of fluoroscopic equipment may perform limited fluoroscopy, when permitted by law, only for the localization of dynamic structures. Fluoroscopy is never to be used as a substitute for routine radiographic positioning examinations."

In states and/or institutions where it is a standard of practice for the radiographer to perform fluoroscopy, this technique must be taught. Where this subject area is included in the curriculum, the Program has specific ethical and legal responsibilities to the patient and student. The student shall be assured that:

- Legal statutes allow performance of this procedure by radiographers
- Professional liability coverage is adequate
- Adequate supervision is provided
- Appropriate, structured, laboratory objectives are identified
- Evaluation and demonstration of total competency occurs before this task is performed unsupervised

5. Describe the optical system of an image intensifier

6. Discuss image formation in terms of image size, framing and brightness

7. Discuss applications of image intensified fluoroscopy

III. Recording Media and Techniques

A. Video Tubes
1. Purpose
2. Construction
3. Applications

B. Video Recorders
1. Purpose
2. Construcction
3. Types
4. Applications

C. Cine Radiography Equipment
1. Purpose
2. Construction
3. Applications

D. Strip Film Cameras
1. Purpose
2. Construction
3. Applications

E. Automatic Film Changers
1. Purpose
2. Types
   -Construction
   -Applications

F. Duplication
1. Purpose
2. Equipment/film
3. Procedure

G. Subtraction
1. Purpose
2. Equipment/film
3. Procedure

H. Image Enlargement
1. Purpose
2. Procedure

IMAGING EQUIPMENT

I. Stereoscopic Radiography
1. Purpose
2. Procedure

J. Polaroid
1. Purpose
2. Equipment/film
3. Procedure

K. Conventional Tomography
1. Purpose
2. Principles
3. Motions
4. Equipment
5. Procedure

Objectives:

1. Discuss video tubes in terms of purpose, construction and applications
2. Discuss video recorders in terms of purpose, construction, types and applications
3. Discuss cine radiography equipment in terms of purpose, construction and applications
4. Discuss strip film cameras in terms of purpose, construction and applications
5. Discuss automatic film changers in terms of purpose, types, construction and applications
6. Discuss duplication in terms of purpose, equipment/film and procedure
7. Discuss subtraction in terms of purpose, equipment/film and procedure
8. Discuss image enlargement in terms of purpose and procedure
9. Discuss stereoscopic radiography in terms of purpose and procedure
10. Discuss Polaroid in terms of purpose, equipment/film and procedure
11. Discuss conventional tomography in terms of purpose, principles, motions, equipment and procedure

IV. Image Noise (Mottle)

A. Definition/Description

B. Types

1. Intensifier
   - -Source
   - -Relation to exposure
   - -Relation to definition
   - -Relation to contrast
   - -Control
2. Film
   - -Source
   - -Relation to exposure
   - -Relation to definition
   - -Relation to contrast
   - -Control
3. Quantum
   - -Source
   - -Relation to exposure
   - -Relation to definition
   - -Relation to contrast
   - -Control

Objectives:

1. Define image noise and describe its appearance

2. Discuss types of image noise in terms of source, relation to exposure, relation to definition, relation to contrast and methods of control

V. Other Imaging Equipment

A. Xeroradiography

1. Purpose
2. Principles
3. Equipment/material
4. Procedure

B. Computed Tomography

1. Purpose
2. Principles
3. Equipment/material
4. Procedure

IMAGING EQUIPMENT

C. Digital Imaging
1. Purpose
2. Principles
3. Equipment/material
4. Procedure

D. Electron Radiography
1. Purpose
2. Principles
3. Equipment/material

E. Nuclear Magnetic Resonance
1. Purpose
2. Principles
3. Equipment/material

F. Other

Objectives:

1. Discuss xeroradiography in terms of purpose, principles, equipment/material and procedure

2. Discuss computed tomography in terms of purpose, principles, equipment/material and procedure

3. Discuss digital imaging in terms of purpose, principles, equipment /material and procedure

4. Discuss electron radiography in terms of purpose, principles and equipment/material

5. Discuss nuclear magnetic resonance in terms of purpose, principles and equipment/material

IMAGING EQUIPMENT

1. Bushong; Radiologic Science for Technologists, 2nd Edition, 1980, C.V. Mosby Company

2. Christensen/Curry/Dowdey; An introduction to the Physics of Diagnostic Radiology, 2nd Edition, 1978, Lea Febiger

3. Cullinan/Cullinan; Illustrated Guide to X-Ray Technics, 2nd Edition, 1980, J.B. Lippincott Company

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5. Gurley/Callaway/etal; Introduction to Radiologic Technology, 1982, Multi-Media Publishing Company

6. Hiss; Understanding Radiography, 1978, Charles C. Thomas

7. Seeram; Computed Tomography Technology, 1982, W.B. Saunders

8. Selman; The Fundamentals of X-Ray and Radium Physics, 6th Edition, 1977, Charles C. Thomas

9. Sprawls; The Physical Principles of Diagnostic Radiology, 1977, University Park Press

RADIOGRAPHIC FILM PROCESSING

This unit will provide the student with the knowledge to process radiographic film. Requirements for the processing area will be identified. Film, film holders and intensifying screens will be discussed. Processing procedures and artifacts will be described.

I. **Processing Area Considerations**

II. **Handling and Storage of Film**

III. **Characteristics of Films Utilized in Radiographic Procedures**

IV. **Film Holders & Intensifying Screens**

V. **The Automatic Processor**

VI. **Artifacts**

VII. **Silver Recovery**

RADIOGRAPHIC FILM PROCESSING

I. Processing Area Considerations

A. Location/Construction/Function

1. Centralized/disbursed
2. Convenience
3. Access
4. Staffing
   - -Darkroom technician
   - -Technologists
5. Ease of operation
   - -Layout
   - -Counter height
   - -Storage

B. Lighting

1. Safe light illumination
   - -Definition
   - -Filters
   - -Bulb size/color
   - -Testing
2. Day light processing

C. Ventilation

1. Temperature control
2. Light proofing

D. Equipment/Furnishings

1. Processor
   - -Location
   - -Purpose
   - -Function/operation
2. Film storage
   - -Location
   - -Purpose
   - -Function
3. Pass boxes
   - -Location
   - -Purpose
   - -Function/operation
4. Counter space
   - -Location
   - -Purpose
   - -Function/operation
5. Printer/film identification
   - -Location
   - -Purpose
   - -Function/operation

RADIOGRAPHIC FILM PROCESSING

Objectives:

1. Discuss aspects of processing area location, construction and function
2. Explain safe light illumination in terms of definition, filters, bulb size/color and testing
3. Describe day light processing
4. Discuss processing area ventilation including considerations of temperature control and light proofing
5. Given a list of equipment/furnishings of a processing area, discuss the location, purpose and function/operation of each

II. Handling and Storage of Film

A. Processing Considerations

1. Temperature
2. Humidity
3. Light
4. Radiation
5. Handling

B. Storage Considerations

1. Temperature
2. Humidity
3. Light
4. Radiation
5. Gases/fumes
6. Handling
7. Pressure
8. Expiration date

Objectives:

1. Analyze the effects of the following on film in terms of processing considerations
   - -Temperature
   - -Humidity
   - -Light
   - -Radiation
   - -Handling

2. Analyze the effects of the following on film in terms of storage considerations
    - -Temperature
    - -Humidity
    - -Light
    - -Radiation
    - -Gases/fumes
    - -Handling
    - -Pressure
    - -Expiration date

III. Characteristics of Films Utilized in Radiographic Procedures

A. Composition
1. Components
2. Structure
3. Function

B. Types
1. Construction
2. Applications

C. Properties
1. Contrast
    - -Definition
    - -Influence
2. Speed
    - -Definition
    - -Influence
3. Latitude
    - -Definition
    - -Influence
4. Recorded detail
    - -Definition
    - -Influence

D. Latent Image Formation
1. Definition
2. Sensitization specks
    - -Definition
    - -Location
    - -Function

E. Characteristic Curve
1. Definition/purpose
2. Sensitometric equipment
3. Graphing
4. Interpretation
5. Evaluation

RADIOGRAPHIC FILM PROCESSING

Objectives:

1. Given cross-sectional diagrams of radiographic film, label the components and describe the structure and function of each component
2. Define properties of radiographic film and analyze the influence of each on the resultant image
3. Define latent image formation
4. Explain how sensitization specks contribute to latent image formation
5. Define characteristic curve and explain its purpose
6. Given density values, graph characteristic curves for radiographic film
7. Given characteristic curves for radiographic film, interpret them
8. Given characteristic curves for various radiographic film, analyze the curves and evaluate various films for specific procedures

IV. Film Holders & Intensifying Screens

A. Film Holders

1. Cassettes
   - -Purpose
   - -Construction
   - -Application
   - -Loading/unloading
   - -Maintenance
2. Disposable
   - -Purpose
   - -Construction
   - -Application
3. Polaroid
   - -Purpose
   - -Construction
   - -Application
   - -Loading/unloading
   - -Maintenance

B. Intensifying Screens

1. Purpose
2. Construction/composition

3. Principles of function
   - -Fluorescence
   - -Phosphorescence
   - -Quantum noise
   - -Film/screen contact
   - -Technical influences
4. Classifications/applications
   - -Phosphor
   - -Speed
   - -Patient dosage
5. Maintenance
   - -Handling
   - -Cleaning
   - -Testing
   - -Evaluation

Objectives:

1. Discuss various film holders in terms of purpose, construction, application, patient dosage, loading/unloading and maintenance
2. Explain the construction and purpose of intensifying screens
3. Describe the principles of function of intensifying screens
4. Explain classifications of intensifying screens and the applications of each
5. Discuss the maintenance of intensifying screens in terms of handling, cleaning, testing and evaluation

V. The Automatic Processor*

A. Unit

1. Purpose
2. Structure
   - -Components
   - -Function

* Based on the state of the art, only automatic processing is included in this curriculum. If educators believe manual processing techniques must be taught, previous editions of the ASRT Curriculum may be referenced.

3. Systems/functions
   - -Chemical
   - -Transport
   - -Replenishment
   - -Recirculation
   - -Temperature control
   - -Wash
   - -Dry

B. Processing Cycle

1. Film feed
   - -Sheet
   - -Roll
   - -Other
2. Development
   - -Action
   - -Time
3. Fix
   - -Action
   - -Time
4. Wash
   - -Action
   - -Time
5. Dry
   - -Action
   - -Time
6. Film exit

C. Maintenance/Cleaning

Objectives:

1. Discuss the purpose of the automatic processor
2. Given cross-sectional diagrams of automatic processors, label the components and explain the function of each
3. Describe systems of the automatic processor and functions of each
4. Given various types and sizes of film, demonstrate how each is fed into the processor
5. Explain the components of the processing cycle providing the specific action and duration of time for each component
6. Discuss daily and periodic aspects of processor maintenance and cleaning

VI. Artifacts

A. Definition

B. Types
1. Cause
2. Effect on radiograph
3. Methods of prevention

Objectives:

1. Define artifact
2. Describe types of artifacts including the cause and effect on a radiograph and methods of prevention for each
3. Given radiographs containing artifacts, identify the type, cause and methods of prevention for each

VII. Silver Recovery

A. Definition

B. Rationale

C. Methods
1. Electrolytic
   - -Process
   - -Advantages
   - -Disadvantages
2. Metallic replacement/ion exchange
   - -Process
   - -Advantages
   - -Disadvantages
3. Discarded film
   - -Unexposed
   - -Exposed

D. Security
1. Control
2. Theft
3. Misappropriation

RADIOGRAPHIC FILM PROCESSING

Objectives:

1. Define silver recovery
2. Explain the rationale for silver recovery
3. Discuss methods of reclamation including process, advantages and disadvantages of each method
4. Discuss silver recovery security as it relates to control, theft and misappropriation

1. Bushong; Radiologic Science for Technologists, 2nd Edition, 1980, C.V. Mosby Company

2. Gurley/Callaway/etal; Introduction to Radiologic Technology, 1982, Multi-Media Publishing Company

3. Hiss; Understanding Radiography, 1978, Charles C. Thomas

4. Major; Medical Silver Recovery, 1982, Metallic Marketing Systems Corporation

5. Selman; The Fundamentals of X-Ray and Radium Physics, 6th Edition, 1977, Charles C. Thomas

6. Sprawls; The Physical Principles of Diagnostic Radiology, 1977, University Park Press

EVALUATION OF RADIOGRAPHS

This unit will provide the student with the knowledge to evaluate radiographic examinations, to identify and recognize diagnostic quality. Film evaluation brings together knowledges and skills from multiple didactic units, laboratory assignments and clinical education. The diverse components of the curriculum that influence evaluation of radiographs will be presented.

I. **Evaluation of the Patient/Order for Radiographic Service**

II. **Film Identification**

III. **Positioning**

IV. **Radiation Protection**

V. **Components of Radiographic Quality**

EVALUATION OF RADIOGRAPHS

I. Evaluation of the Patient/Order for Radiographic Service

A. Patient Identification
1. Name/unit number
2. Age
3. Location

B. Procedure(s) To Be Performed

C. Clinical Data
1. Age
2. Sex
3. History

D. Rationale for Radiographic Examination
1. Clinical symptoms
2. Disease process(es)

E. Degree of Examination Difficulty
1. Patient age
2. Condition of patient
3. Educational level of student

II. Film Identification

A. Patient Information

B. Date of Examination

C. "R" or "L"

D. Other

III. Positioning

A. Anatomy

B. Anatomical Variations

C. Body Habitus

D. Positioning Aids

E. Factors
1. Central ray placement
2. Beam alignment/angulation

3. Body part rotation
4. Plane/baseline reference

IV. Radiation Protection

A. Film Size

B. Film/Screen Combination

C. Collimation

D. Shielding

E. Repeats

V. Components of Radiographic Quality

A. Visibility
1. Density
2. Contrast

B. Geometry
1. Recorded detail
2. Distortion

C. Processing

D. Artifacts

Objective:

As the student begins to perform radiographic examinations, under supervision, and continuing throughout the program; evaluation of radiographs takes place.

Regular, formal sessions should be scheduled under the direction of faculty and with peers in attendance. Radiographic images are presented by students with evaluation of the items identified in this unit.

Student(s) progress through the educational curriculum and the resultant advancement in examination difficulty and complexity should be reflected in the evaluations.

PHYSICS

This unit will provide the student with a knowledge of basic physics. Fundamentals of x-ray generating equipment are discussed. Information on x-ray production, beam characteristics and units of measurement is provided.

I. **Units of Measurement**

II. **General Principles**

III. **Structure of the Atom**

IV. **Structure of Matter**

V. **Electrostatics**

VI. **Magnetism**

VII. **Electrodynamics**

VIII. **Electromagnetism**

IX. **Rectification**

X. **X-Ray Tubes**

XI. **X-Ray Circuits**

XII. **Production and Characteristics of Radiation**

RADIATION PHYSICS

I. Units of Measurement

A. Fundamental Units
1. Length
2. Mass
3. Time

B. Derived Units
1. Area
2. Volume
3. Density
4. Specific gravity
5. Velocity
6. Temperature

C. Systems of Measurement
1. English
2. Metric

Objectives:

1. State the fundamental units of the English and Metric systems
2. Define derived units of the English and Metric systems
3. Given problems, convert units from one system to the other

II. General Principles

A. Mass
1. Inertia
2. Momentum

B. Force
1. Work
2. Power

C. Energy
1. Types
2. Laws of conservation

D. Relationship Between Matter and Energy

RADIATION PHYSICS

Objectives:

1. Define and describe the general principles that relate to inertia, work, energy and momentum
2. Define derived units of the English and Metric systems
3. Given problems, convert units from one system to the other

III. Structure of the Atom

A. Nucleus

1. Components
   - -Proton
   - -Neutron
   - -Other
2. Structure
   - -Neutron/proton ratio
   - -Binding energy

B. Electron Shells

1. Components
2. Arrangement
   - -Binding energy
   - -Movement
   - -Ionization

C. Nomenclature

1. Atomic number
2. Mass number
3. Isotope
4. Isomer
5. Ion

Objectives:

1. Describe Bohr's theory of atomic structure
2. Discuss the characteristics and function of a proton
3. Discuss the characteristics and function of a neutron
4. Discuss the characteristics and function of an electron
5. Describe the energy levels of the atom
6. Define terms relating to atomic nomenclature
7. Compare covalent bonding to ionic bonding
8. Explain the process of ionization

IV. Structure of Matter

A. Elements
1. Definition
2. Periodic table

B. Compounds
1. Definition
2. Molecule

Objectives:

1. Define element
2. Describe the characteristics of an element using the periodic table
3. Define compound
4. Describe the characteristics of a molecule

V. Electrostatics

A. Electrical charge
1. Definition
2. Source

B. Electrical Field
1. Definition
2. Source

C. Methods of Electrification
1. Friction
2. Contact
3. Induction

D. Laws of Electrostatics

Objectives:

1. Define electrical charge and describe its source
2. Define electrical field and describe its source
3. Explain methods of electrification
4. Explain the Laws of Electrostatics and their application

VI. Magnetism

A. Properties
1. Poles
2. Fields
3. Laws

B. Domain Theory
1. Electron spin
2. Arrangement

C. Induction
1. Principle
2. Methods
3. Material classification

Objectives:

1. Discuss the properties of magnetism
2. Discuss the laws of magnetism
3. Discuss the domain theory
4. Relate the electronic spin of an element to its potential magnetic properties
5. Explain the principle of magnetic induction
6. Given a list of materials, classify according to magnetic characteristics

VII. Electrodynamics

A. Moving charges

1. Potential difference
2. Current
   - -Direct
   - -Alternating
3. Resistance
4. Circuit

B. Measuring Devices

1. Galvanometer
2. Ammeter
3. Voltmeter

C. Protective Devices

1. Fuse
2. Ground
3. Circuit Breaker

Objectives:

1. Define potential difference, current and resistance
2. Describe the characteristics of direct and alternating currents
3. Given a schematic diagram of a resistance circuit, label the parts
4. Apply Ohm's Law to solve direct current problems
5. Describe electrical measuring devices

6. Given a schematic diagram of a circuit, label the electrical measuring devices

7. Describe electrical protective devices

VIII. Electromagnetism

A. Interaction - Electric/Magnetic Fields

B. Induction
1. Self
2. Mutual

C. Applications
1. Generators
   - -Type
   - -Function
2. Motors
   - -Type
   - -Function
3. Transformers
   - -Type
   - -Function
4. Coils
   - -Type
   - -Function

Objectives:

1. Explain the interaction between electric and magnetic fields

2. Discuss types of electromagnetic induction

3. Describe types and functions of generators, motors, transformers and coils

4. Compare single phase to three phase generators in terms of radiation production and efficiency

IX. Rectification

A. Definition

B. Purpose

C. Devices

1. Solid state
   - -Function
   - -Advantages/disadvantages
2. Vacuum tubes
   - -Function
   - -Advantages/disadvantages

Objectives:

1. Define rectification
2. Explain the purpose of rectification
3. Compare solid state and vacuum tube rectification in terms of function and advantages/disadvantages

X. X-Ray Tubes

A. Construction

1. Anode
   - -Description
   - -Function
2. Cathode
   - -Description
   - -Function
3. Tube housing
   - -Description
   - -Function

B. Thermal Capacity

1. Tube rating
2. Anode cooling
3. Housing cooling

Objectives:

1. Discuss the characteristics of a rotating anode in terms of description and function
2. Discuss the characteristics of a cathode in terms of description and function
3. Discuss the construction characteristics of tube housing in terms of description and function

4. Discuss the characteristics of cables in terms of description and function

5. Given a diagram of an x-ray tube, label the parts

6. Given tube rating charts, determine maximum allowable exposure factors for various radiographic procedures

7. Given simulated exposure factors, use an anode cooling chart to determine the anode cooling rate

8. Given simulated exposures and a housing cooling chart, determine heat units and cooling characteristics of x-ray tube housings

XI. X-Ray Circuits

A. Primary Circuit
1. Components
2. Function

B. Secondary Circuit
1. Components
2. Function

C. Filament Circuit
1. Components
2. Function

Objectives:

1. Describe the components of an x-ray primary circuit and explain the function of each component

2. Describe the components of an x-ray secondary circuit and explain the function of each component

3. Describe the components of an x-ray filament circuit and explain the function of each component

4. Given a simple diagram of a complete x-ray circuit, label the parts

XII. Production and Characteristics of Radiation

A. X-ray Production
1. Principle

2. Processes
   - -Bremsstrahlung
   - -Characteristic
3. Necessary conditions
   - -Source
   - -Acceleration
   - -Decelaration

B. Interactions of X-ray with Matter

1. Photoelectric effect
   - -Description of interaction
   - -Relation to atomic number
   - -Application
2. Compton scattering
   - -Description of interaction
   - -Relation to atomic number
   - -Application
3. Unmodified scattering (coherent)
   - -Description of interaction
   - -Relation to atomic number
   - -Application
4. Pair production
   - -Description of interaction
   - -Relation to atomic number
   - -Application
5. Photodisintegration
   - -Definition

C. Beam Characteristics

1. Penetration
2. Absorption
3. Scatter

D. Units of Measurement

1. Coulomb/kilogram (Roentgen)
2. Gray (Rad)
3. Sievert (Rem)
4. Electron volt

Objectives:

1. State the principle of x-ray production
2. Compare the production of Bremsstrahlung with the production of characteristic radiations
3. Describe the conditions necessary to produce x-radiation
4. Discuss various photon interactions in terms of description of interaction, relation to atomic number and applications

5. Define photo disintegration

6. Discuss relationships of wavelength and frequency to beam penetration, absorption and scatter

7. Define units of radiation measurement and provide an example of radiology application

RADIATION PHYSICS

1. Bushong; Radiologic Science for Technologists, 2nd Edition, 1980, C.V. Mosby Company

2. Christensen/Curry/Dowdey; An Introduction to the Physics of Diagnostic Radiology, 2nd Edition, 1978, Lea Febiger

3. Selman; The Fundamentals of X-Ray and Radium Physics, 6th Edition, 1977, Charles C. Thomas

4. Sprawls; The Physical Principles of Diagnostic Radiology, 1977, University Park Press

PRINCIPLES OF RADIATION PROTECTION

This unit will provide the student with principles of radiation protection. Radiation protection responsibility by the radiographer to patients, personnel and the public is presented. Maximum permissible dose and regulatory involvement is discussed.

I. **Introduction**

II. **Radiation Detection and Measurement**

III. **Patient Protection**

IV. **Personnel Protection**

V. **Maximum Permissible Dose (MPD)**

VI. **Agencies and Regulations**

PRINCIPLES OF RADIATION PROTECTION

I. Introduction

A. Historical Perspectives
1. Evolution of standards
2. Public Law 97-35 (The Patient Consumer Radiation Health and Safety Act of 1981)
3. Public awareness

B. Origins
1. Natural radiation
2. Manmade radiation

C. Responsibility
1. Legal
2. Ethical

Objectives:

1. Discuss historical perspectives relating to radiation protection
2. Explain the two purposes of Public Law 97-35
3. List major natural and manmade radiation origins
4. Discuss radiographer radiation protection responsibility as it pertains to patients, personnel and the public

II. Radiation Detection and Measurement

A. Units
1. Coulomb/kilogram (Roentgen)
2. Gray (Rad)
3. Sievert (Rem)
4. Becquerel (Curie)

B. Personnel Monitoring Devices
1. Film badge
2. Thermoluminescent dosimeter
3. Pocket ionization chamber

C. Instruments - Principle/Applications
1. Ionization chambers
   - -Victoreen R-meter
   - -Cutie pie

2. Geiger-Mueller detector
   -Principle
   -Applications
3. Other

Objectives:

1. Discriminate among various units of radiation
2. Discuss personnel monitoring devices in terms of types, purpose, characteristics, advantages/disadvantages
3. List and describe types of ionization chambers
4. Explain the theory of operation for an ionization chamber
5. Explain the theory of operation for a Geiger-Mueller detector

III. Patient Protection

A. Beam Limiting Devices

B. Filtration

C. Shielding

D. Ten Day Rule

E. Exposure Factors

F. Film/Screen Combinations

G. Repeat Radiographs

Objectives:

1. Explain the relationship of beam limiting devices to patient radiation protection
2. Discuss added and inherent filtration in terms of the effect on patient dosage
3. Explain the purpose and importance of patient shielding
4. Given a list of patient shielding devices and radiographic procedures, correlate the method of shielding to the radiographic procedure

5. Explain the ten day rule and its application to female patients of childbearing age

6. Explain the relationship of exposure factors to patient dosage

7. Given various radiographic procedures, state the desired film/screen combination that will result in an optimum diagnostic image with the minimum radiation exposure to the patient

8. Discuss methods to avoid repeat radiographs

IV. Personnel Protection

A. Room Construction/Design

1. Walls
2. Windows
3. Doors
4. Control booth
5. Other

B. Radiologic Equipment/Technique

1. Distance
2. Beam limiting
3. Exposure control cord length
4. Other

C. Personnel Protective Devices

1. Aprons
2. Gloves
3. Movable shields
4. Other

D. Patient Restraint Devices

Objectives:

1. Explain the use of primary and secondary radiation barriers

2. Discuss protection devices influencing room construction/design

3. Explain how radiologic equipment/techniques and protection devices are used to reduce personnel exposure during radiographic, fluoroscopic, mobile and surgical procedures

4. Explain how patient restraint devices are used to reduce personnel exposure during radiographic, fluoroscopic, mobile and surgical procedures

V. Maximum Permissible Dose (MPD)

A. Definition

B. Formula

C. Dose

1. Occupational
   - -Pregnant radiographer
   - -Whole body
   - -Body part
2. General public

Objectives:

1. Define Maximum Permissible Dose
2. Using the MPD formula, calculate the dose limit for radiographers of various ages
3. Discuss MPD as it relates to the pregnant radiographer
4. Differentiate beteween whole body and body part doses for radiographers
5. Discuss the difference between occupational and general public radiation exposure

VI. Agencies and Regulations

A. Agencies

1. Federal
2. State

B. Regulations

1. Public Law 97-35
2. The ALARA Concept (As Low As Reasonably Achievable)

Objectives:

1. Identify Federal and State regulatory agencies
2. Discuss regulations influencing radiation protection

PRINCIPLES OF RADIATION PROTECTION

1. Bushong; Radiologic Science for Technologists, 2nd Edition, 1980, C.V. Mosby Company

2. Frankel; Radiation Protection for Radiologic Technologists, 1976, McGraw Hill

3. Gurley/Callaway/etal; Introduction to Radiologic Technology, 1982, Multi-Media Publishing Company

4. Public Law 97-35, 1981, The Government Printing Office

5. Selman; The Fundamentals of X-Ray and Radium Physics, 6th Edition, 1977, Charles C. Thomas

6. Sprawls; The Physical Principles of Diagnostic Radiology, 1977, University Park Press

PRINCIPLES OF RADIATION BIOLOGY

This unit will provide the student with the principles of cell radiation interaction. Radiation effects on cells and factors affecting cell response are presented. Acute and chronic effects of radiation are discussed.

I. **Introduction**

II. **Cell Anatomy**

III. **Radiation/Cell Interaction**

IV. **Effects of Radiation**

RADIOGRAPHIC PATHOLOGY

This unit will provide the student with an introduction to the concepts of disease. Pathology and disease as it relates to various radiographic procedures will be discussed.

I. **Introduction to Pathology**

II. **Trauma/Physical Injury**

III. **Systemic Classifications of Disease**

IV. **Repair and Replacement of Tissue**

B. Muscular
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

C. Digestive
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

D. Respiratory
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

E. Urinary
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

F. Reproductive
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

G. Circulatory
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis

6. Radiographic procedures
7. Affect on radiographic technique

H. Reticuloendothelial
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

I. Endocrine
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

J. Nervous
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

K. Sense Organs
1. Definition
2. Etiology
3. Examples/sites
4. Complications
5. Prognosis
6. Radiographic procedures
7. Affect on radiographic technique

Objectives:

1. List systemic classifications of disease and define each

2. Describe etiology and examples/sites of systemic classifications of disease

3. Discuss complications and prognosis of examples of systemic classifications of disease

4. Describe radiographic procedures and affects on radiographic technique for examples of systemic classification of disease

IV. Repair and Replacement of Tissue

A. Causes

1. Pathological
   - -Process
   - -Examples
2. Traumatic
   - -Process
   - -Examples
3. Surgical
   - -Process
   - -Examples

B. The Healing Process

C. Complications

Objectives:

1. Discuss causes of tissue disruption, describe the process and give examples of each
2. Describe the healing process
3. Discuss complications connected with the repair and replacement of tissue

RADIOGRAPHIC PATHOLOGY

1. Brinkbok; Pathology for Radiographers, 1965, Butterworths

2. Boyd/Sheldon; Introduction to the Study of Disease, 8th Edition, 1980, Lea Febiger

3. Kent/Hart/Shires; Introduction to Human Disease, 1979, Appleton-Century-Crofts

4. Walter; An Introduction to the Principles of Disease, 1977, W.B. Saunders

INTRODUCTION TO QUALITY ASSURANCE

This unit will provide the student with an introduction to the evaluation of radiographic systems to assure consistency in the production of quality images. The components involved in the radiography system will be identified. Tests and procedures to evaluate these components will be discussed. State and federal impacts will be described.

I. **Quality Assurance Concepts**

II. **Monitoring and Maintenance**

III. **State and Federal Regulations**

INTRODUCTION TO QUALITY ASSURANCE

I. Quality Assurance Concepts

A. Definitions
1. Quality assurance
2. Quality control

B. Benefits
1. Patient
   - -Reduction in radiation exposure
   - -Efficacy of patient care
2. Departmental
   - -Consistency in production of quality diagnostic images
   - -Cost effectiveness

C. Elements
1. Standards for quality
2. Communications
3. Quality assurance manual
4. Responsibility/administration
5. Test equipment/procedures/training
6. Recordkeeping
7. Test review
8. Evaluation

Objectives:

1. Define quality assurance and quality control
2. Discuss the benefits of a quality assurance program to the patient and to the department
3. List elements of quality assurance and discuss how each is related to the quality assurance program

II. Monitoring and Maintenance

A. Responsibility
1. Radiographer
2. Quality Control/Quality Assurance Technologist
3. Physicist
4. Service Engineer
5. Radiologist

B. Components of the Radiographic System

1. Radiographic units
   - -Test material/equipment
   - -Test procedures
   - -Evaluation/interpretation
   - -Preventative maintenance
   - -Corrective maintenance
2. Fluoroscopic units
   - -Test material/equipment
   - -Test procedures
   - -Evaluation/interpretation
   - -Preventative maintenance
   - -Corrective maintenance
3. Tomographic units
   - -Test material/equipment
   - -Test procedures
   - -Evaluation/interpretation
   - -Preventative maintenance
   - -Corrective maintenance
4. Processors/darkrooms
   - -Test material/equipment
   - -Test procedures
   - -Evaluation/interpretation
   - -Preventative maintenance
   - -Corrective maintenance
5. Illuminators
   - -Test material/equipment
   - -Test procedures
   - -Evaluation/interpretation
   - -Preventative maintenance
   - -Corrective maintenance
6. Cassettes/Intensifying screens
   - -Test material/equipment
   - -Test procedures
   - -Evaluation/interpretation
   - -Preventative maintenance
   - -Corrective maintenance
7. Grids
   - -Test material/equipment
   - -Test procedures
   - -Evaluation/interpretation
   - -Preventative maintenance
   - -Corrective maintenance
8. Protective devices
   - -Test material/equipment
   - -Test procedures
   - -Evaluation/interpretation
   - -Preventative maintenance
   - -Corrective maintenance
9. Other

C. Retake Analysis Program

1. Definition
2. Objective
3. Procedure
4. Evaluation
5. Follow up

Objectives:

1. List categories of departmental personnel involved in a quality assurance program and discuss the responsibilities of each to the effective operation of the program

2. List components of the radiography system

3. Describe test material/equipment, test procedures and evaluation/ interpretation relating to quality assurance for components of the radiographic system

4. Discuss aspects of preventative and corrective maintenance for components of the radiography system

5. Define retake analysis and describe objectives of a retake analysis program

6. Explain the procedure, evaluation and follow up for a retake analysis program

7. Perform quality control tests to include:
   - -Processor monitoring
   - -Source to image receptor distance accuracy and beam restriction adequacy
   - -Accuracy/reproducibility of exposure time
   - -X-ray tube protective circuitry
   - -Exposure reproducibility, linearity and beam quality
   - -Focal spot size and consistency
   - -kVp accuracy
   - -Grid alignment
   - -Automatic exposure control system evaluation
   - -Film/screen contact
   - -Uniformity of screen speed
   - -Uniformity of radiographic illuminators
   - -Protective device integrity

III. State and Federal Regulations

A. State

1. Agency involvement
2. Regulations
3. Inspections
4. Enforcement

B. Federal

1. Agency involvement
2. Regulations
3. Information/consultation service

Objectives:

1. Identify state agencies involved with quality assurance aspects of radiographic systems
2. Discuss state agency regulations, inspections and enforcement as they relate to quality assurance
3. Identify federal agencies involved with quality assurance aspects of radiographic systems
4. Discuss federal regulations and enforcement/consultation service as they relate to quality assurance

INTRODUCTION TO QUALITY ASSURANCE

1. Bushong; Radiologic Science for Technologists, 2nd Edition, 1980, C.V. Mosby Company

2. Cullinan/Cullinan; Illustrated Guide to X-Ray Technics, 2nd Edition, 1980, J.B. Lippincott Company

3. Gray/Winkler/Stears/Frank; Quality Control in Diagnostic Imaging, 1982, University Park Press

4. Gurley/Callaway/etal; Introduction to Radiologic Technology, 1982, Multi-Media Publishing Company

5. Hendee/Chaney/Rossi; Radiologic Physics, Equipment and Quality Control, 1977, Yearbook Medical Publishers

6. Jenkins; Radiographic Photography and Imaging Processes, 1980, University Park Press

7. McLemore; Quality Assurance in Diagnostic Radiology, 1981, Yearbook Medical Publishers

8. Quality Assurance for Radiographic X-Ray Units and Associated Equipment, (FDA 79-8094), The Government Printing Office

INTRODUCTION TO COMPUTER LITERACY

This unit will introduce the student to fundamental principles of computer technology. Computer concepts and terminology will be discussed. Computer applications in radiology will be identified.

I. **History**

II. **Fundamentals**

III. **Components**

IV. **Operation**

V. **Computer Applications in Radiology**

INTRODUCTION TO COMPUTER LITERACY

I. History

A. Abacus

B. Mechanical

C. Electric

D. Electronic

Objective:

1. Discuss the history of computers

II. Fundamentals

A. Definition

B. Terminology

C. Types

1. General purpose/mainframe
2. Minicomputer
3. Microcomputer

Objectives:

1. Define computer
2. Define various terms related to computer fundamentals
3. Identify types of computers

III. Components

A. Terminology

B. Central Processing Unit (CPU)

C. Input/Output Devices (I/O) (Peripherals)

1. Input
   - -Punch card
   - -Punched paper tape
   - -Keyboards
   - -Video terminals
2. Output
   - -Printers
   - -Cathode Ray Tube (CRT)

Objectives:

1. Define various terms related to components of computers
2. List major functions of a CPU
3. Given a list of input/output devices, differentiate between them

IV. Operation

A. Terminology

B. Analog Computers

C. Digital Computers

D. Binary Function

E. Programming

1. Definition
2. Purpose
3. Languages
   - -ALGOL
   - -A.P.L. (A Programming Language)
   - -BASIC
   - -COBOL
   - -FORTRAN
   - -PASCAL
   - -PL/1 (Programming Language Version 1)

Objectives:

1. Define various terms related to computer operation
2. Discuss analog to digital conversion
3. Explain the binary function

4. Define programming and describe its purpose

5. List various computer languages

V. Computer Applications in Radiology

A. Imaging

1. Computed tomography (C.T.)
2. Digital radiology
3. Radiation therapy treatment planning
4. Nuclear medicine applications
5. Ultrasound applications

B. Management

1. Patient records
2. Patient scheduling
3. Quality assurance documentation
4. Film file inventory
5. Computer assisted instruction (CAI)
6. Staffing
7. Business functions

Objectives:

1. Describe various imaging applications of computers in radiology

2. Describe various management applications of computers in radiology

1. Enlander; Computers in Medicine - An Introduction, 1980, C.V. Mosby Company

2. Seeram; Computed Tomography Technology, 1982, W.B. Saunders

3. Shelly/Chaskman; Introduction to Computers and Data Processing, Anaham Publishing Company

4. Spencer; Computers in Action, 2nd Edition, 1978, Hayden Book Company

5. Explain the ten day rule and its application to female patients of childbearing age

6. Explain the relationship of exposure factors to patient dosage

7. Given various radiographic procedures, state the desired film/screen combination that will result in an optimum diagnostic image with the minimum radiation exposure to the patient

8. Discuss methods to avoid repeat radiographs

IV. Personnel Protection

A. Room Construction/Design
1. Walls
2. Windows
3. Doors
4. Control booth
5. Other

B. Radiologic Equipment/Technique
1. Distance
2. Beam limiting
3. Exposure control cord length
4. Other

C. Personnel Protective Devices
1. Aprons
2. Gloves
3. Movable shields
4. Other

D. Patient Restraint Devices

Objectives:

1. Explain the use of primary and secondary radiation barriers

2. Discuss protection devices influencing room construction/design

3. Explain how radiologic equipment/techniques and protection devices are used to reduce personnel exposure during radiographic, fluoroscopic, mobile and surgical procedures

4. Explain how patient restraint devices are used to reduce personnel exposure during radiographic, fluoroscopic, mobile and surgical procedures

V. Maximum Permissible Dose (MPD)

A. Definition

B. Formula

C. Dose

1. Occupational
   - -Pregnant radiographer
   - -Whole body
   - -Body part
2. General public

Objectives:

1. Define Maximum Permissible Dose
2. Using the MPD formula, calculate the dose limit for radiographers of various ages
3. Discuss MPD as it relates to the pregnant radiographer
4. Differentiate beteween whole body and body part doses for radiographers
5. Discuss the difference between occupational and general public radiation exposure

VI. Agencies and Regulations

A. Agencies

1. Federal
2. State

B. Regulations

1. Public Law 97-35
2. The ALARA Concept (As Low As Reasonably Achievable)

Objectives:

1. Identify Federal and State regulatory agencies
2. Discuss regulations influencing radiation protection