

# The Professional Curriculum for Radiography

Committee on Education

Sub-Committee on  
Radiography Curriculum Revision

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**The American Society of Radiologic Technologists**

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## Preface

This revision of the Professional Curriculum for Radiography represents the cognitive base of entry level education in the practice of radiography. The professional curriculum is presented in defined course content units. The course content shall be delivered in entirety. Additional information may be incorporated in each content area as deemed appropriate.

Instructional methods to deliver the professional curriculum are typically lecture, laboratory and clinical practicum. The educational community is encouraged to also include seminars, discussion groups, case studies and clinical conferences as elements of the professional curriculum for radiography.

Curriculum sequence in each program, while an instructional or programmatic prerogative, should reflect modern educational philosophy and practice. As the cognitive base of the professional educational process of radiographers, curriculum sequence is the blueprint by which basic knowledge is translated into effective, competent clinical practice.

The bibliography is not intended to be inclusive or exclusive of all available instructional resources nor is it intended to serve as an endorsement of the publications. The educational community is encouraged to supplement the bibliography with topical information from new publications, journals, periodicals and other media.

The ASRT is grateful to the Committee members for their invaluable contribution and expertise in development of the professional curriculum. Critical review by members of the educational community, practitioners and radiologists is also appreciated. The efforts of these professionals has resulted in this professional curriculum for the preparation of radiographers.

## **GENERAL EDUCATION**

### **PRIMARY ADVANTAGE:**

#### **General education provides:**

- Greater accessibility for career mobility and advanced education.
- Increased parity with other allied health disciplines.

#### **Rationale for general education in college programs:**

The requirement of general education for college radiography programs is chided by some as an embellishment or inflation of education for radiographers. On the contrary, given the more recent high technology of medicine, radiographers have a proven need for enhancement of interpersonal skills for interacting with patients, staff, and the public. The courses listed on the following pages for high school graduates are intended to serve as background education for all radiography programs. General education at the college level is intended to further develop high school educational skills and place graduates in the job market with a more competitive increased level of education, thus increasing the potential of career success.

## GENERAL EDUCATION CONTINUED

The following high school courses are recommended prior to admission by all radiography programs:

### SCIENCE

#### Biology I

Biology I offers pupils exploratory experiences and activities in the fundamental concepts of life. Biology I expands and refines the biological concepts introduced in the elementary and middle school/junior high grades. Laboratory/field experiences are an integral component of Biology I.

#### Chemistry I

Chemistry I offers pupils general laboratory experiences and activities in the concepts of chemistry through the study of the position of substances and of their effects upon one another.

#### Physics I

Physics I offers pupils general laboratory experiences and activities in the concepts of the physical interactions of matter and energy.

### MATH

#### Algebra I

Provides an understanding of basic algebra, the concepts, skills structure, and applications are emphasized.

#### Algebra II

Provides detailed knowledge of algebra with the emphasis on in-depth development of algebraic functions.

#### Geometry

An understanding of and appreciation for geometric concepts, emphasis placed on discovery, proof, and application of geometric relationships and principles.

#### Note:

Non-traditional students who did not complete high school but later earned a GED may be evaluated based on GED math and science scores.

## GENERAL EDUCATION CONTINUED

The following general education courses are recommended for, but not limited to, college-based radiography programs to reinforce high school requirements:

### **English Composition I**

This course introduces students to the writing of brief informal essays, with primary attention given to academic writing. Several short essays and a final examination are required of each student. English also provides a basic introduction to research methods and the library.

### **English Composition II**

Writing of extended compositions, including research papers requiring knowledge of library resources and conventions of formal documentation; extension of critical reading skills developed in English I. More advanced treatment of critical reading skills is also provided. Each student will write at least one longer research paper and several critical papers.

### **Intermediate Algebra**

**Prerequisite:** Elementary algebra or its equivalent. Algebraic and rational expressions, exponents and radicals, theory of quadratic equations, introduction of polynomial, rational exponential, and logarithmic functions.

### **Fundamental Physics with Lab**

An introduction to the physics of mechanics; levers, pulleys, and wedges. Electricity and magnetism; electrical conduction, and magnets. Optics: color, mirrors, and lenses.

### **Fundamental Psychology**

Introduction to the methods and major content areas of psychology: sensation, perception, learning, cognition, human development, abnormal and social psychology.

### **Computer Literacy**

### **Basic information course**

### **Note:**

To convert quarter hours to semester hours for classification purposes, total the number of credit hours earned and multiply by .67.

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# **INTRODUCTION TO RADIOGRAPHY**

## **COURSE DESCRIPTION**

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.

## **COURSE OUTLINE**

- I. Introduction to the Educational Program
- II. The Health Care Delivery System
- III. Hospital Organization
- IV. Organization of the Department of Radiology
- V. Accreditation and Credentialing
- VI. Professional Organizations
- VII. Professional Development
- VIII. Basic Radiation Protection

# INTRODUCTION TO RADIOGRAPHY

## I. Introduction to the Educational Program

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT

#### A. General Information

1. Student insurance
2. Textbooks
3. Dress code
4. Policies
  - a. Absence
  - b. Attendance
  - c. Disciplinary
  - d. Educational rights
  - e. Grading
  - f. Grievance/appeal
  - g. Health
  - h. Pregnancy
  - i. Tuition/fees
  - j. Vacation
  - k. Other
5. Educational schedules
  - a. Didactic
  - b. Clinical
6. Graduation requirements

#### B. Clinical Education

1. Rules and regulations
2. Schedules
  - a. Patient
  - b. Staff
  - c. Conference
3. Equipment
4. Records
5. Medical emergencies
6. Incident reports
7. Security
8. Clinical education centers

#### C. Duties/Responsibilities of the Student Radiographer

1. Didactic
  - a. Schedule



- b. Attendance
- c. Assignments
- d. Testing/evaluation

2. Laboratory

- a. Schedule
- b. Attendance
- c. Assignments
- d. Testing/evaluation

3. Clinical

- a. Schedule
- b. Assistance
- c. Assignments
- d. Supervision
- e. Testing/evaluation

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## II. The Health Care Delivery System

### OBJECTIVES

Following the completion of this unit, the student will:

1. List and discuss components of the health care delivery system.
2. Identify major issues and problems associated with health care delivery.
3. Define and discuss the concept of preventive health care.
4. Define and discuss the concept of holistic health care and its related components.
5. Identify modalities of Radiologic Sciences.
6. Describe the function of each modality.
7. Identify other disciplines of the health care delivery system.
8. Describe the function of each discipline as a member of the health care team.

### CONTENT

#### A. Health Care Delivery System

1. Components/Definitions
  - a. Health
  - b. Health Care Delivery System
  - c. Allied Health Professions
  - d. Health Education - Professional vs. Community
  - e. Health Educator - Professional vs. Community
  - f. Retrospective cost based payment system
  - g. Prospective, flat rate payment system
  - h. DRGs
  - i. HMO
  - j. PPO
2. Issues
  - a. The American health care system's conflicting roles
  - b. Controlling the accelerating cost of health care in America
  - c. Accessibility to health care (Quantity vs. Quality issues & Equity issues)
  - d. Disease prevention vs. disease treatment
3. Problems
  - a. Americas' diet and exercise habits
  - b. Charity care and social inequities
  - c. Child care in America
  - d. Drug and alcohol abuse
  - e. AIDS and other social diseases
  - f. Environmental hazards
  - g. The aging of America
4. Preventive health care
  - a. The 1979 Healthy People report by U.S. Surgeon General Califano
  - b. The 15 priority areas from the 1980 Objectives of the Nation document
  - c. Concept of accidents and illnesses must be prevented rather than treated
  - d. Shifting the health care model from disease treatment to disease prevention
  - e. Economic motivation for preventive health care
  - f. Federal government support for preventive health care
  - g. HMO's
5. Holistic health care
  - a. Definitions: Holism & Holistic medicine
  - b. Orthodox medicine to Holistic medicine
  - c. Three important principles of Holistic medicine
  - d. The Holistic Model - chart provided as handout
  - e. The physician's role: mechanic or gardner?

f. Directions in holistic health and medicine

Note: Areas A, 1-5 are optional and must be continuously updated.

B. Radiologic Sciences

1. Roles in health promotion/disease prevention
  - a. Radiographer
  - b. Radiation Therapists
  - c. Nuclear Medicine Technologist
  - d. Diagnostic Medical Sonographer

C. Other Health Care Disciplines

1. Medical records
2. Medical technology
3. Medicine (Physicians)
4. Nursing
5. Occupational therapy
6. Pharmacy
7. Physical therapy
8. Respiratory therapy

### **III. Hospital Organization**

#### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

#### **CONTENT**

- A. Philosophy/Mission
- B. Administrative Services
  1. Governing board
  2. Medical director
  3. Administrator
  4. Staff
    - a. Medical
    - b. House
  5. Students
    - a. Health professions
    - b. Nursing
    - c. Medical
  6. Admissions
  7. Medical records
  8. Business offices
  9. Personnel department
- C. Radiological Services
  1. Radiography/diagnostic medical imaging
  2. Radiation therapy/radiation oncology
  3. Nuclear medicine
  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

## **IV. Organization of the Department of Radiology**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

#### **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

## V. Accreditation and Credentialing

### OBJECTIVES

Following the completion of this unit, students will:

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.

### CONTENT

#### A. Accreditation

1. Definition
2. Agencies
  - a. The Joint Review Committee on Education in Radiologic Technology (JRCERT)
  - b. The Committee on Allied Health Education and Accreditation (CAHEA)
  - c. Regional and/or State
3. Essentials and Guidelines of an Accredited Educational Program for the Radiographer

#### B. Credentialing

1. Definition
  - a. Certification
  - b. Licensure
  - c. Registration
2. Agencies
  - a. The American Registry of Radiologic Technologists (ARRT)
  - b. State

## **VI. Professional Organizations**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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

### **CONTENT**

- A. Purposes, Functions and Activities
- B. National/International
  1. The American Society of Radiologic Technologists (ASRT)
  2. The International Society of Radiographers and Radiological Technicians (ISRRT)
  3. The American College of Radiology (ACR)
  4. The Radiological Society of North America (RSNA)
- C. Regional/State/District

## **VII. Professional Development**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

- A. Career Mobility
  1. Employment outlook
  2. Economic return
- B. Career Advancement
  1. Other radiologic technology modalities
  2. Administration/education
  3. Advanced technology
    - a. Specialized diagnostic imaging
    - b. Research/scholarly activity
  4. Commercial
  5. Government
- C. Continuing Education
  1. Definition
  2. Rationale/benefits
  3. Opportunities



## **VIII. Basic Radiation Protection**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

#### **A. Purpose**

1. Patient
2. Personnel

#### **B. Principles**

1. Patient safety
  - a. Pregnancy
  - b. Beam limiting
  - c. Shielding
2. Personnel safety
  - a. Pregnancy
  - b. Beam limiting
  - c. Shielding
  - d. Distance
3. Personnel monitoring
  - a. Devices
  - b. Reports

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- Journal of Allied Health. Special issue on Health Promotion/Disease Prevention, (vol. 15 ), November 4, 1986.
- The Joint Review Committee on Education in Radiologic Technology. (1983) Essentials and Guidelines of an Accredited Educational Program for the Radiographer.

# **MEDICAL ETHICS AND LAW**

## **COURSE DESCRIPTION**

This unit is designed to provide the student with an understanding of the parameters of professional practice. It will include a discussion of the radiographer's major areas of responsibility in the delivery of health care.

## **COURSE OUTLINE**

- I. Ethical Responsibilities
- II. Legal Responsibilities
- III. Patient Consent
- IV. Hospital and Departmental Policies

# MEDICAL ETHICS AND LAW

## I. Ethical Responsibilities

### OBJECTIVES

Following the completion of this unit, the student will:

1. Define the term ethics and discuss the related terms biomedical ethics and professional ethics.
2. Discuss the role values play in an individual's concept of ethics.
3. Discuss the standards of the ASRT Code of Ethics.
4. Discuss the standards of a Patient Bill of Rights.
5. Given simulated situations, solve problems in a professionally acceptable manner.

### CONTENT

- A. Definition
- B. Role of Values
- C. ASRT Code of Ethics
- D. Patient Bill of Rights
- E. Problem Solving

## **II. Legal Responsibilities**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Define the following terms:
  - a. Direct professional liability
  - b. Indirect professional liability
  - c. Gross negligence
  - d. Contributory negligence
  - e. Standard of care
  - f. Negligence
2. Define the following terms:
  - a. Libel/slander
  - b. Assault/battery
  - c. False imprisonment
  - d. Invasion of privacy
  - e. Breach of confidentiality
3. Discuss the elements necessary for a valid malpractice claim.
4. Define and discuss the doctrines of:
  - a. Vicarious liability
  - b. Borrowed servant
  - c. Respondeat superior
  - d. Res ipsa loquitur
5. Discuss the ASRT scope of practice for the radiographer and describe the elements that comprise it.
6. Discuss the limits of responsibility for the radiographer as defined by the scope of practice.
7. Discriminate between professional and legal standards and describe how each relates to radiography practice.
8. Discuss institutional and professional liability protection typically available to the radiographer.

### **CONTENT**

- A. Parameters of Legal Responsibility
  1. Professional liability
    - a. Direct
    - b. Indirect
  2. Intentional misconduct
    - a. Libel and slander
    - b. Assault and battery
    - c. False imprisonment
    - d. Invasion of privacy
    - e. Breach of confidentiality

3. Negligence/malpractice
    - a. Definitions
      1. Gross
      2. Contributory
    - b. Elements of malpractice
      1. Duty
      2. Dereliction (breach)
      3. Causation
      4. Damage
  4. Doctrines
    - a. Vicarious liability
    - b. Borrowed servant/captain of the ship
    - c. Respondeat superior
    - d. Res ipsa loquitor
  5. Legal and professional standards
    - a. Standard of care
    - b. Scope of practice
  6. Protection
    - a. Individual
    - b. Institutional
- B. Selected Responsibilities of the Radiographer
1. Correct patient identification
  2. Correct identification/markings of films
  3. Accurate assessment of patient condition prior to/during radiographic examination
  4. Composition of radiographic image quality

### III. Patient Consent

#### OBJECTIVES

Following the completion of this unit, the student will:

1. Define the term informed consent.
2. Describe the elements necessary for informed consent.
3. Discuss standards for disclosure relative to informed consent.
4. Describe how consent forms are utilized relative to specific radiographic procedures.
5. Discuss how consent forms are used in legal action.

#### CONTENT

- A. Definition
- B. Types
  1. Implied
  2. Written
  3. Oral
- C. Conditions for Valid Consent
  1. Legal age
  2. Mental competence
  3. Voluntary
  4. Appropriately/adequately informed regarding case, procedure, alternatives and risk
  5. American Hospital Association (AHA) and Joint Commission on Accreditation for Health Organizations (JCAHO) Standards for Disclosure
- D. Documentation of Consent
  1. Form and contents
  2. Use in legal actions

## **IV. Hospital and Departmental Practices**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Describe necessity for and process of recording accurate patient information.
2. Describe ownership of and need for availability of patient records.
3. Given simulated situations, respond to various types of request for information.
4. Discuss the importance of observing, reporting, and documenting patient/examination information.

### **CONTENT**

- A. Patient Records
  1. Authorizations for procedures
  2. Ownership/availability of information/records
  3. Release of information/records
- B. Information to Patient
  1. General release of information
  2. Explanation of procedures
  3. Radiation protection
  4. Diagnosis/prognosis
- C. Documentation/Reporting
  1. Clinical history
  2. Exposure factors
  3. Contrast media
    - a. Type
    - b. Volume
    - c. Administration
  4. Unusual occurrences/incident reports
- D. Confidentiality
  1. Patient/patient records
  2. Professional
  3. Institutional



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# **MEDICAL TERMINOLOGY**

## **COURSE DESCRIPTION**

This unit will provide the student with the elements of medical terminology. An introduction to the origins of medical terminology will be addressed. A word building system will be introduced, and abbreviations and symbols will be discussed. Also introduced in this course will be an orientation to the understanding of radiographic orders and an interpretation of diagnostic reports.

## **COURSE OUTLINE**

- I. Introduction to the Origins of Medical Terminology
- II. The Word Building Process
- III. Medical Abbreviations and Symbols
- IV. Understanding Radiographic Orders and Diagnostic Reports

# MEDICAL TERMINOLOGY

## I. Introduction to the Origin of Medical Terminology

### OBJECTIVES

Following the completion of this unit, the student will:

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

### CONTENT

#### A. Primary Language Sources

1. Greek
2. Latin

#### B. Secondary Language Sources

1. English
2. French
3. German

## II. The Word Building Process

### OBJECTIVES

Following the completion of this unit, the student will:

1. Given medical terms, separate and define each according to its basic elements.
2. Given medical terms in noun and verb forms, change each to adjectives and/or adverb forms.
3. Translate medical terms into common language a patient could understand.
4. Correctly pronounce medical terms.
5. Given medical terms, correctly change singular forms to plural form.

### CONTENT

- A. Basic Elements
  1. Root words
  2. Prefixes
  3. Suffixes
- B. Combining Forms
- C. Parts of Speech
  1. Nouns
  2. Verbs
  3. Adjectives
  4. Adverbs
- D. Translation of Terms into Common Language
- E. Correct Pronunciation of Medical Terms
- F. Correct Singular/Plural Word Forms

### **III. Medical Abbreviations and Symbols**

#### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

#### **CONTENT**

- A. Role in Communication
- B. Abbreviations
  1. Examples
  2. Interpretations
- C. Symbols
  1. Examples
  2. Interpretations

## **IV. Understanding Radiographic Orders and Diagnostic Reports**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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

### **CONTENT**

#### **A. Radiographic Orders/Requisitions - Components**

1. Procedures ordered
2. Patient history
3. Clinical information

#### **B. Diagnostic reports**

1. Contents
2. Interpretation

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# METHODS OF PATIENT CARE

## COURSE DESCRIPTION

This unit will provide the student with the basic concepts of patient care, including consideration for the physical and psychological needs of the patient and family. Routine and emergency patient care procedures will be described, as well as infection control procedures utilizing Universal Precautions. The role of the radiographer in patient education will be identified.

## COURSE OUTLINE

- I. Introduction to Patient Care
- II. General Patient Care
- III. Interacting With the Terminally Ill
- IV. Obtaining Vital Signs
- V. Asepsis
- VI. Infection Control
- VII. Emergency Situations
- VIII. Contrast Media
- IX. Patient Education
- X. Pharmacology



# METHODS OF PATIENT CARE

## I. Introduction to Patient Care

### OBJECTIVES

Following the completion of this unit, the student will:

1. Discuss the responsibilities of the health care facility.
2. Discuss the responsibilities of the radiographer.

### CONTENT

- A. Responsibilities of the Health Care Facility
  1. Caring for the ill & trauma patients
  2. Promoting health
  3. Preventing disease
  4. Education
  5. Research
- B. Responsibilities of the Radiographer
  1. Performing radiographic examinations
  2. Assisting the radiologist
  3. Patient Care
    - a. Physical needs
    - b. Psychological needs
    - c. Radiation protection and safety
    - d. Patient education
  4. Promoting health

## II. General Patient Care

### OBJECTIVES

Following the completion of this unit, the student will:

1. Describe and demonstrate good principles of body mechanics applicable to patient care.
2. Demonstrate techniques for various types of patient transfers.
3. Describe and demonstrate the procedures for turning patients with various conditions.
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 property of inpatients and outpatients.

### CONTENT

- 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
- C. Turning the Patient
  1. Patient condition
    - a. Severe trauma
    - b. Unconsciousness
    - c. Disorientation
    - d. Amputation
  2. Mechanics
  3. Safety
- D. Restraint Techniques
  1. Trauma patient
  2. Pediatric patient
  3. Geriatric patient
  4. Physically handicapped patient
  5. Emotionally disturbed patient

E. Methods of Administering Parenteral Fluids

1. Intravenous
  - a. Description/purpose
  - b. Considerations
2. Intramuscular
  - a. Description/purpose
  - b. Considerations
3. Subcutaneous
  - a. Description/purpose
  - b. Considerations
4. Intra-Arterial
  - a. Description/purpose
  - b. 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

H. Special Patient Conditions

1. Tubes/catheters
  - a. Nasogastric
  - b. Chest
  - c. Urinary
  - d. Intravenous
  - e. Oxygen
2. Casts
3. Surgical
4. Cardiac
5. Unconsciousness
6. Disorientation
7. Inebriation

I. Security of Patient Property

1. Inpatient
2. Outpatient

### **III. Interacting With the Terminally Ill**

#### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Discuss how the patient and the professional understand the process of dying.
2. Discuss the ethical, emotional and physical aspects of death.
3. List the stages of dying and describe the characteristics of each stage.
4. Identify the support mechanisms available to the terminally ill.

#### **CONTENT**

##### **A. Understanding the Process of Dying**

1. Patient
2. Professional

##### **B. Aspects of Death**

1. Emotional
  - a. Suicide
  - b. Euthanasia
2. Personal
  - a. Religious
  - b. Cultural
3. Physical
  - a. Pain
  - b. Suffering
  - c. Disability
  - d. 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

## **IV. Obtaining Vital Signs**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Explain what each vital sign is and discuss its significance in the assessment of 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. Given a simulated patient, measure and record each of the vital signs and record them.

### **CONTENT**

- A. Definitions
  1. Temperature
  2. Pulse
  3. Respiration
  4. Blood pressure
- B. Physiological Principles of Each
- C. Normal Values
- D. Equipment Used
- E. Records

## V. Asepsis

### OBJECTIVES

Following the completion of this unit, the student will:

1. Define each of the following:
  - a. Asepsis
  - b. Antiseptic/disinfectant
  - c. Sterile/clean
  - d. Sterile area/contaminated area
  - e. Endogenous infections/ectogenous infections
2. List some common antiseptics.
3. Describe methods of sterilization.
4. Discuss the following procedures:
  - a. Scrubbing
  - b. Proper gowning and donning of gloves
  - c. Handling of instruments
  - d. Maintenance of a sterile area
5. Explain the principles for care of wounds.

### CONTENT

#### A. Definitions

1. Asepsis
2. Antiseptic/disinfectant
3. Sterile/clean
4. Sterile area/ contaminated area
5. Endogenous infections/ectogenous infections

#### B. Common Antiseptics

#### C. Methods of Sterilization

1. Autoclave
2. Dry heat
3. Chemical
4. Gas

#### D. Considerations

1. Procedures
  - a. Scrub
  - b. Gown
  - c. Glove
  - d. Instruments
2. Sterile areas

E. Care of Wounds

1. Cleansing
2. Dressing

ASPT

## VI. Infection Control

### OBJECTIVES

Following the completion of this unit, the student will:

1. Define each of the following:
  - a. Infectious pathogens
  - b. Communicable diseases
  - c. Nosocomial infections
  - d. Center of Disease Control - (CDC)
  - e. Human Immunodeficiency Virus - (HTV)
  - f. Hepatitis B Virus - (HBV)
2. Describe the utilization of Universal Precautions and Isolation Procedures.
3. Describe sources and modes for transmission of infections and diseases.
4. Describe institutional/departmental procedures for infection control through Universal Precautions.
5. Discuss psychological considerations for the management of patients utilizing Universal Precautions.

### CONTENT

- A. Definitions
  1. Infectious pathogens
  2. Communicable diseases
  3. Nosocomial infections
  4. Center for Disease Control - (CDC)
  5. Human Immunodeficiency Virus - (HIV)
  6. Hepatitis B Virus - (HBV)
- B. Universal Precautions and Isolation
  1. Precautions for:
    - a. Blood, body fluids and secretions
  2. Isolation for:
    - a. Respiratory tract - air borne
    - b. Burn patients
- C. Infectious Sources
  1. Bacteria
  2. Virus
- D. Transmission Modes
  1. Aerobic
  2. Direct contact
  3. Indirect contact
  4. Disease prevention
- E. Procedures for Infection Control Through Universal Precautions
  1. Institutional
  2. Departmental
- F. Psychological Considerations



## VII. Emergency Situations

### OBJECTIVES

Following the completion of this unit, the student will:

1. Identify symptoms which manifest the following emergencies:
  - a. Cardiac arrest
  - b. Anaphylactic shock
  - c. Convulsion/seizure
  - d. Hemorrhage
  - e. Apnea
  - f. Vomiting
  - g. Aspiration
  - h. Suspected/confirmed fractures
  - i. Diabetic coma/insulin shock
2. Describe the emergency medical code system for the institution and discuss the role of the student in this procedure.
3. Given a CPR manniken, demonstrate CPR competency.
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 and suction equipment.
7. Given simulations, demonstrate basic first aid techniques.

### CONTENT

- A. Recognition of Emergencies
  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 shock
- B. Determination/Evaluation
  1. Vital signs
  2. Institutional medical emergency code
- C. Acute Care Procedures
  1. Cardiopulmonary resuscitation
  2. Hemorrhage control
  3. Suction

D. Equipment/Supplies

1. Oxygen
2. Aspirator
3. Resuscitator
4. Medications
5. Emergency cart

ASPRF

## VIII. Contrast Media

### OBJECTIVES

Following the completion of this unit, the student will:

1. Define the categories of contrast media and give specific examples for each category.
2. Discuss the pharmacology of barium compounds.
3. Discuss the pharmacology of iodine compounds.
4. Describe methods and techniques for the administration of various types of contrast media.

### CONTENT

#### A. Definitions

1. Radiolucent
  - a. Air
  - b. Gases
2. Radiopaque
  - a. Barium compounds
  - b. Aqueous iodine compounds
  - c. Oily iodine compounds
  - d. Non-ionic compounds

#### B. Pharmacology

1. Barium compounds
  - a. Patient history/allergy
  - b. Chemical composition
  - c. Patient precautions
  - d. Patient reactions
  - e. Emergency care
2. Iodine compounds (ionic/non-ionic)
  - a. Patient history/allergy
  - b. Chemical composition
  - c. Patient precautions
  - d. Patient reactions
  - e. Emergency care

#### C. Methods of Administration

1. Systemic
  - a. Oral
  - b. Rectal
  - c. Tube/Catheter
  - d. Inhalation

2. Parenteral
  - a. Intravenous
  - b. Intra-arterial
  - c. Intrathecal

D. Administration Techniques

1. Oral
  - a. Tablets
  - b. Capsules
  - c. Granules
  - d. Liquids
2. Tube/catheter
  - a. Nasogastric
  - b. Urinary
  - c. Enema
  - d. Other
3. Intravenous<sup>1</sup>
  - a. Syringe/needle
  - b. Infusion container/catheter/needle

<sup>1</sup>In states and/or institutions where it is 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 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

## **IX. Patient Education**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

#### **A. Communication**

1. Definition
2. Methods
  - a. Oral
  - b. Written word
  - c. Pictures
  - d. 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

#### **C. Explanation of Examinations**

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

D. Radiation Safety /Protection

1. Shielding
  - a. Contact
  - b. Shadow
2. Collimation

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## **X. Pharmacology**

### **OBJECTIVES**

Following the completion of this unit, the radiographer will:

1. Recognize various categories of drugs.
2. Recognize common drug nomenclature and basic concepts of pharmacology.
3. Discuss specific drugs in each category.
4. Discuss each drug's expected actions, reactions, and possible interactions.
5. Discuss specific drugs for CPR procedures.
6. Discuss drugs used for premedication including recognition of initial and peak response times.

### **CONTENT**

#### **A. Introduction**

1. Definitions
2. Basic concepts
  - a. Site of action
  - b. Mechanism of action
  - c. Receptor site
  - d. Agonists and antagonists
  - e. Dose-response relationships
  - f. Time-response relationships
3. Drug safety
  - a. Four rights
4. Drug nomenclature
5. Drug abuse

#### **B. Biological Factors Affecting the Action of Drugs**

1. Dosage forms
  - a. Aqueous preparations
  - b. Alcoholic preparations
  - c. Solid and semisolid preparations
2. Routes of Administration
  - a. Syringes
  - b. Needles
3. Drug absorption
4. Drug distribution
5. Drug metabolism

6. Drug excretion
  - a. Renal
  - b. GI
  - c. Respiratory
  - d. Miscellaneous
7. Half-life
8. Blood drug levels
9. Bioavailability
10. Factors that may vary response
  - a. Age
  - b. Weight
  - c. Sex
  - d. Species differences
  - e. Time
  - f. Emotional factors
  - g. Pre-existing disease
  - h. Previous drug history
11. Drug interactions
12. Therapeutic uses of drug

#### C. Classification of Drugs

1. Analgesics
  - a. Pain - acute/chronic
  - b. Narcotics (opioid)
  - c. Non-narcotic and anti-inflammatory drugs
2. Antipsychotic, antiemetic, antianxiety drugs
3. Antidepressants, psychomotor stimulants, lithium
4. Antiarrhythmic drugs
5. Antianginal agents (vasodilators)
6. Diuretics
7. Antihypertensive agents
8. Anticoagulants and coagulants
9. Antiallergic/antihistamine drugs
10. Bronchodilator drugs
11. Antiulcer Therapy
12. Adrenal steroids
13. Gonadal hormones and oral contraceptives
14. Antibacterial agents
15. Antiprotozoal drugs
16. Antiseptics and disinfectants

#### D. Cardio-pulmonary Resuscitation Drugs



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# HUMAN STRUCTURE AND FUNCTION

## COURSE DESCRIPTION

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

## COURSE OUTLINE

- 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
- IVX. Reticuloendothelial System
- XV. Endocrine System
- XVI. Nervous System
- XVII. Special Senses
- XVIII. Integumentary System
- IXX. Transverse Anatomy
- XX. Topographic Anatomy

# HUMAN STRUCTURE AND FUNCTION

## I. Anatomical Nomenclature

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT

#### A. Terms of Direction

1. Anterior/posterior
2. Ventral/dorsal
3. Medial/lateral
4. Superior/inferior
5. Proximal/distal
6. Cephalad/caudad

#### B. Body Planes

1. Median/mid-sagittal
2. Sagittal
3. Coronal
4. Transverse
5. Longitudinal

## II. Cells

### OBJECTIVES

Following the completion of this unit, the student will:

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 occurrence.

### CONTENT

- A. Structure
  1. Nucleus
  2. Cytoplasm
- B. Function/Reproduction
  1. Interphase
    - a. Protein synthesis
    - b. Cell differentiation
  2. Mitosis
    - a. Prophase
    - b. Metaphase
    - c. Anaphase
    - d. Telophase
  3. Meiosis
- C. Aberrations

### **III. Tissues**

#### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Identify the germinal layers of the embryo.
2. List each type of tissue and give an example of a location where each type might be found.
3. Compare and contrast structural and functional characteristics of each of the tissue classifications.
4. Describe the following tissue types:
  - a. Epithelial
  - b. Connective
  - c. Muscle
  - d. Nerve
5. Name and locate types of body membranes.

#### **CONTENT**

- A. Embryonic Layers
- B. Types (To Include Structure, Function and Location)
  1. Epithelial
  2. Connective
  3. Muscle
  4. Nerve
- C. Body Membranes
  1. Mucous
  2. Serous
  3. Synovial
  4. Cutaneous

## **IV. Body Cavities**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Discuss each of the body cavities in terms of structural limits, function and contents.

### **CONTENT**

#### **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

## V. Bone

### OBJECTIVES

Following the completion of this unit, the student will:

1. Compare and discuss intramembranous 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.

### CONTENT

#### A. Formation

1. Intramembranous ossification
2. Endochondral ossification

#### B. Structure

1. Medullary cavity/marrow
2. Compact bone
3. Cancellous bone
4. Periosteum
5. Cartilage
  - a. Hyaline
  - b. Fibrous
  - c. 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
  - a. Condyle
  - b. Head
  - c. Trochanter
  - d. Crest
  - e. Spine
  - f. Tuberosity
  - g. Tubercle
2. Depressions/openings
  - a. Fossa
  - b. Sinus
  - c. Foramen

d. Meatus

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## VI. Articulations

### OBJECTIVES

Following the completion of this unit, the student will:

1. Define articulation.
2. Given diagrams of articulations, locate and label the component part.
3. Discuss each type of articulation, including a definition of the type of comparison with other types, locations, and movement(s) permitted.

### CONTENT

- 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
    - a. Fibrous
    - b. Cartilaginous
  3. Locations
- E. Amphiarthrosis
  1. Definition
  2. Types
    - a. Fibrocartilaginous
  3. Locations
  4. Movement
    - a. Limited
- F. Diarthrosis
  1. Definition
  2. Types
    - a. Ball and socket
    - b. Hinge
    - c. Pivot
    - d. Ellipsoidal/condyloid
    - e. Saddle
    - f. Gliding
  3. Locations
  4. Movement
    - a. Flexion
    - b. Extension
    - c. Abduction
    - d. Adduction

- e. Rotation
- f. Circumduction
- g. Inversion
- h. Eversion
- i. Special

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## VII. Skeletal System

### OBJECTIVES

Following the completion of this unit, the student will:

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 skeleton, locate and identify sutures of the skull.
5. Given radiographs, diagrams, and 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 sesamoid bone and locate examples of radiographs.
9. Discuss the functions of the skeletal system.

### CONTENT

#### A. Axial

1. Skull
  - a. Cranium
  - b. Facial bones
  - c. 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

## VIII. Muscular System

### OBJECTIVES

Following the completion of this unit, the student will:

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

### CONTENT

#### A. Functions

1. Movement
2. Posture
3. Heat production

#### B. Types

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

## IX. Digestive System

### OBJECTIVES

Following the completion of this unit, the student will:

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 function.
6. Describe the salivary glands in terms of structure, locations, and function.
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 among 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.

### CONTENT

#### A. Mouth

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

#### B. Primary Organs

1. Esophagus
  - a. Structure/location
  - b. Functions
2. Stomach
  - a. Structure/location
  - b. Function

3. Small intestine
  - a. Structure/location
  - b. Functions
4. Large intestine
  - a. Structure/location
  - b. Functions
5. Rectum
  - a. Structure/location
  - b. Functions
6. Anal Canal/anus
  - a. Structural/location
  - b. Function

C. Accessory Organs

1. Pancreas
  - a. Structure/location
  - b. Secretions
  - c. Function
2. Liver
  - a. Structure/location
  - b. Secretions
  - c. Function
3. Gallbladder
  - a. Structure/location
  - b. Function

D. Digestion

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

## **X. Respiratory System**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

- A. Nose/Nasal Cavity
  1. Structure
  2. Function
- B. Paranasal Sinuses
  1. Structure/location
  2. Function
- C. Pharynx
  1. Structure/location
  2. Function
- D. Larynx
  1. Structure/location
  2. Function
- E. Trachea
  1. Structure/location
  2. Function
- F. Bronchi
  1. Structure/location
  2. Function
- G. Lungs
  1. Structure/location
  2. Function

## H. Respiration

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

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## **XI. Urinary System**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Given diagrams and radiographs, label the 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.

### **CONTENT**

#### **A. Organs**

1. Kidneys
  - a. Structure/location
  - b. Function
2. Ureters
  - a. Structure/location
  - b. Function
3. Bladder
  - a. Structure/location
  - b. Function
4. Male urethra
  - a. Structure/location
  - b. Function
5. Female urethra
  - a. Structure/location
  - b. Function

#### **B. Urine**

1. Composition
2. Formation

#### **C. Micturition**

## **XII. Reproductive System**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Given diagrams of the male reproductive system, label the parts.
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. Describe the role of the female in reproduction.

### **CONTENT**

#### **A. Male**

1. Testes
  - a. Structure/location
  - b. Function
2. Internal accessory organs
  - a. Structure/location
  - b. Function
3. External organs
  - a. Structure/location
  - b. Function
4. Reproduction
  - a. Definition
  - b. Spermatogenesis
  - c. Coitus

#### **B. Female**

1. Ovaries
  - a. Structure/location
  - b. Function
2. Internal accessory organs
  - a. Structure/location
  - b. Functions
3. External organs
  - a. Structure/location
  - b. Function
4. Mammary glands
  - a. Structure/location
  - b. Function

5. Sexual cycles
  - a. Ovarian
  - b. Menstrual
  
6. Reproduction
  - a. Definition
  - b. Ovulation
  - c. Insemination
  - d. Fertilization
  - e. Segmentation
  - f. Histogenesis

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## XIII. Circulatory System

### OBJECTIVES

Following the completion of this unit, the student will:

1. Given a diagram of the heart, label the 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. Describe the 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.

### CONTENT

#### A. Hemopoietic

1. Heart
  - a. Structure/location
  - b. Function
2. Blood vessels
  - a. Types
  - b. Structure
  - c. Function
3. Blood
  - a. Composition
  - b. Types
  - c. Function
  - d. Pressure
4. Circulation
  - a. Pulmonary
  - b. Systemic
  - c. Fetal

#### B. Lymphatic

1. Lymphatics
  - a. Structure/location
  - b. Function
2. Lymph nodes
  - a. Structure/location
  - b. Function
3. Lymph organs
  - a. Structure
  - b. Function
4. Lymph
  - a. Composition
  - b. Function

5. Circulation

ASPT

## **XIV. Reticuloendothelial System**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Explain the function of the reticuloendothelium.
2. List the sites where reticuloendothelial tissues would be found.
3. Describe the function of macrophages.

### **CONTENT**

- A. Function
- B. Reticuloendothelial system
  1. Liver
  2. Spleen
  3. Bone marrow
  4. Lymph node line
- C. Macrophages (including function)

## **XV. Endocrine System**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

- 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. Pancreas (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



## **XVI. Nervous System**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Define 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.

### **CONTENT**

#### **A. Types of Nerve Cells**

1. Afferent neurons
  - a. Structure
  - b. Function
2. Efferent neurons
  - a. Structure
  - b. Function

#### **B. Nerve Impulse**

1. Stimulus
2. Receptor
3. Response

#### **C. Brain**

1. Structure
  - a. Cerebrum
  - b. Cerebellum
  - c. Brain stem
2. Function

#### **D. Meninges**

1. Components
  - a. Dura mater
  - b. Arachnoid
  - c. Pia meter
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
    - a. Structure
    - b. Function
  - 2. Parasympathetic
    - a. Structure
    - b. Function

## **XVII. Special Senses**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Describe the structure of the eye.
2. Describe the structure of the components of the ear.
3. Given diagrams, identify and locate components of the
  - a. External ear
  - b. Middle ear
  - c. Inner ear
  - d. Eustachian tubes
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.

### **CONTENT**

- A. Sight
  1. Component
  2. Structure
- B. Hearing/Equilibrium
  1. Components
    - a. External ear
    - b. Middle ear
    - c. Inner ear
    - d. 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

## **XVIII. Integumentary System**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Identify the structures of the integumentary system.
2. Define and discuss terms related to disease conditions at the integumentary system.
3. Define and discuss terms related to treatment of disease conditions of the integumentary system.

### **CONTENT**

#### **A. Structures**

1. **Skin**
  - a. Function
  - b. Protection
  - c. Sensation
  - d. Temperature control
  - e. Secretion
  - f. Related Terms
2. **Hair**
  - a. Function
  - b. Related Terms
3. **Glands**
  - a. Sebaceous
  - b. Sweat
4. **Nails**
  - a. Function
  - b. Related Terms

#### **B. Diseases**

1. **Terminology**
  - a. Common disease conditions
  - b. Treatment of disease conditions

## **XIX. Transverse Anatomy**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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

### **CONTENT**

- A. Head and Neck
  1. Structures/locations
  2. Imaging applications
    - a. Computed tomography
    - b. Magnetic resonance
    - c. Other imaging modalities
- B. Thorax
  1. Structures/location
  2. Imaging applications
    - a. Computed tomography
    - b. Magnetic resonance
    - c. Other imaging modalities
- C. Abdomen/Pelvis
  1. Structures/location
  2. Imaging applications
    - a. Computed tomography
    - b. Magnetic resonance
    - c. Other imaging modalities

## XX. Topographic Anatomy

### OBJECTIVE

Following the completion of this unit, the student will:

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

### CONTENT

- 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

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# **RADIOGRAPHIC PROCEDURES**

## **COURSE DESCRIPTION**

This unit is designed to provide the student with the knowledge and skill necessary to perform standard radiographic procedures and a summary knowledge of special studies. Consideration will be given to the production of radiographs of optimal diagnostic quality. Laboratory experience should be used to complement the classroom portion of the course.

## **COURSE OUTLINE**

- I. Introduction to Radiographic Procedures
- II. General Considerations
- III. Positioning Considerations for Routine Radiographic Procedures
- IV. Positioning Considerations for Routine Considerations Studies
- V. Procedural Considerations for Routine Special Studies



# RADIOGRAPHIC PROCEDURES

## I. Introduction to Radiographic Procedures

### OBJECTIVES

Following the completion of this unit, the student will:

1. Describe standard positioning aids and discuss each in terms of appropriate usage.
2. Describe accessory equipment and discuss each in terms of appropriate usage.

### CONTENT

#### A. Standard Terminology for Positioning/Projection

1. Standard terms
  - a. Radiographic position
  - b. Radiographic projection
  - c. Radiographic view
2. Positioning terminology
  - a. Recumbent
  - b. Supine
  - c. Prone
  - d. Trendelenburg
  - e. Decubitis
3. Erect/upright
  - a. Anterior position
  - b. Posterior position
  - c. Oblique position
4. General planes
  - a. Sagittal/mid-sagittal
  - b. Coronal/mid-coronal
  - c. Transverse
  - d. Longitudinal
5. Skull lines
  - a. Glabellomeatal line
  - b. Interpupillary line
  - c. Orbitomeatal line
  - d. Infraorbitomeatal line
  - e. Acanthiomeatal line
  - f. Glabelloalveolar line
6. Skull points
  - a. Auricular point
  - b. Gonion (angle)
  - c. Mental point
  - d. Acanthion
  - e. Nasion
  - f. Glabella
  - g. Inner canthus
  - h. Outer canthus
  - i. Infraorbital margin

7. Terminology of movement and direction
  - a. Cephalad/caudad
  - b. Inferior/superior
  - c. Proximal/distal
  - d. Plantar/palmar
  - e. Pronate/supinate
  - f. Flexion/extension
  - g. Abduction/adduction
  - h. Inversion/eversion

B. Positioning aids

1. Sponges
2. Sandbags
3. Compression bands
4. Restraining devices

C. Accessory equipment

1. Calipers
2. Lead strips
3. Lead shields/shadow shields
4. Lead markers
5. Film holders

## II. General Considerations

### OBJECTIVES

Following the completion of this unit, the student will:

1. Discuss general procedural considerations for radiographic examinations.
2. Given simulated clinical situations, explain the specific considerations that would be involved.
3. Through role playing, demonstrate the ability to use the appropriate general considerations in various radiographic procedures with various patient types.

### CONTENT

- A. Evaluation of Radiographic Orders
  1. Patient identification
  2. Verification of procedure(s) ordered
  3. Review of clinical history
- B. Establishment of Patient Rapport
  1. Patient assessment
  2. Procedure explanation
  3. Determination of status re: pregnancy
- C. Patient Preparation
  1. Verification of appropriate dietary preparation
  2. Verification of appropriate medication preparation
  3. Appropriate disrobing and gowning
  4. Removal of potential artifacts
- D. Room Preparation
  1. Cleanliness, organization, appearance
  2. Necessary supplies and accessory equipment
- E. Patient Assistance
- F. Patient Monitoring
- G. Evaluation of Radiograph/Patient Dismissal

### III. Positioning Considerations for Routine Radiographic Procedures

#### OBJECTIVES

Following the completion of this unit, the student will:

1. Describe the process for routine and special views for procedures listed below.
2. Given the names of various procedures, explain what structures and/or functions are demonstrated.
3. In a laboratory setting, simulate the radiographic procedure on a person or full body phantom.
4. Given radiographs, evaluate in terms of: positioning, centering, and overall image quality.
5. Given radiographs, identify relevant anatomy.

#### CONTENT

- A. Patient Instructions
- B. Patient Position
- C. Part Placement
- D. Film Selection/Placement
- E. Beam Alignment/Angulation
- F. Beam Limitation/Shielding
- G. Special Considerations
  1. Atypical patients
  2. Mobile unit procedures
  3. Surgical unit procedures
- H. Application of Considerations II.A - II.G and III.A - III.G Positioning for the Following Studies:
  1. Skeletal system
    - a. Upper extremity
      1. Phalanges
      2. Metacarpals
      3. Carpals
      4. Forearm (radius/ulna)
      5. Elbow
      6. Humerus
    - b. Shoulder girdle
      1. Shoulder
      2. Scapula
      3. Clavicle
      4. Acromioclavicular joints
    - c. Lower extremity
      1. Phalanges
      2. Metatarsals
      3. Tarsals
      4. Calcaneus or os calcis
      5. Ankle
      6. Leg (tibia/fibula)
      7. Knee
      8. Femur
    - d. Pelvic girdle

1. Pelvis
2. Hip
- e. Spine
  1. Cervical spine
  2. Thoracic spine
  3. Lumbosacral spine
  4. Sacrum and coccyx
  5. Sacroiliac joints
- f. Bony thorax
  1. Ribs
  2. Sternum
  3. Sternoclavicular joints
- g. Skull/facial bones
  1. Skull
  2. Sella turcica
  3. Paranasal sinuses
  4. Facial bones
  5. Nasal bones
  6. Orbits
  7. Optic foramina
  8. Zygomatic arches
  9. Mandible
  10. Temporomandibular joints
  11. Mastoids
  12. Internal auditory canal
2. Respiratory system
  - a. Chest
  - b. Lungs
3. Digestive system
  - a. Abdominal viscera
  - b. Mesentary
4. Reproductive system
  - a. Mammography
  - b. Pelvimetry (as needed))
  - c. Fetogram (as needed)

## IV. Positioning Considerations for Routine Contrast Studies

### OBJECTIVES

Following the completion of this unit, the student will:

1. Discuss equipment and supplies necessary for each of the studies below.
2. Describe the patient preparation necessary for various contrast studies.
3. Describe the general procedure for each of the radiographic studies below.
4. Describe the process for routine and special views for the procedures listed below.
5. Given the names of various contrast studies, indicate the contrast media typically used, the usual dosage and route of administration.
6. In a laboratory setting, simulate the radiographic procedure on a person or full body phantom.
7. Given the names of various procedures, explain what structures and/or functions are demonstrated.
8. Given radiographs, evaluate in terms of: positioning, centering, and overall image quality.
9. Given radiographs, identify relevant anatomy.

### CONTENT

- A. Patient Position
- B. Part Placement
- C. Film Selection/Placement
- D. Beam Alignment/Angulation
- E. Beam Limitation/Shielding
- F. Patient Instructions
- G. Special Considerations
  1. Atypical patients
  2. Mobile unit procedures
  3. Surgical unit procedures
- H. Contrast Media
  1. Type
  2. Dosage
  3. Administration
- I. Application of Considerations II.A - II.G and IV.A - IV.H to Positioning for the Following Studies:
  1. Gastrointestinal tract
    - a. Esophagus
    - b. Upper G.I.
    - c. Small bowel series
    - d. Barium enema

2. Biliary tract
  - a. Oral cholecystogram
  - b. IV cholangiogram
  - c. T-tube cholangiogram
  - d. Operative cholangiogram
  - e. Percutaneous transhepatic cholecystogram
  
3. Urinary system
  - a. IVP
  - b. Retrograde pyelogram
  - c. Retrograde cystogram
  - d. Cystourethrogram

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## V. Procedural Considerations for Routine Special Studies

### OBJECTIVES

Following the completion of this unit, the student will:

1. Discuss equipment and supplies necessary for each of the studies below.
2. Describe the patient preparation necessary for various special studies.
3. Describe the general procedure for each of the radiographic studies below.
4. Given the names of various special studies, list their general purpose and what anatomy/function is demonstrated.
5. Given the names of various special studies, indicate the contrast media typically used, the usual dosage and route of administration.
6. Given various special study images, identify the specific study being done, the structure visualized and the function demonstrated.

### CONTENT

- A. Equipment/Materials Needed
- B. Contrast Media
- C. General Procedure
- D. Patient Preparation and Patient Care Considerations
- E. Patient/Body Part Positioning
- F. Structures/Functions Demonstrated
- G. Application of Above Considerations to the Following Studies:
  1. Arthrography
  2. Bronchography
  3. Dacryocystography
  4. Hysterosalpingography
  5. Lymphangiography
  6. Myelography
  7. Sialography
  8. Venography



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# PRINCIPLES OF RADIOGRAPHIC EXPOSURE

## COURSE DESCRIPTION

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.

## COURSE OUTLINE

- 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 Calculation

# PRINCIPLES OF RADIOGRAPHIC EXPOSURE

## I. Radiographic Density

### OBJECTIVES

Following the completion of this unit, the student will:

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

### CONTENT

- 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. Filtration
  11. Heel effect

## II. Radiographic Contrast

### OBJECTIVES

Following the completion of this unit, the student will:

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

### CONTENT

- A. Definition
- B. Types
  1. Long scale
  2. Short scale
- C. Components
  1. Subject
  2. Film
- D. Factors
  1. kVp
  2. Scattered radiation
  3. Grids
  4. Beam limitation
  5. Filtration
  6. Intensifying screens
  7. Patient considerations
  8. Distance
  9. Processing
  10. Fog
  11. Contrast media

### **III. Recorded Detail**

#### **OBJECTIVES**

Following the completion of this unit, the student will:

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

#### **CONTENT**

- A. Definition
- B. Components
  1. Umbra
  2. Penumbra
- C. Factors
  1. Geometric unsharpness
    - a. Focal film distance
    - b. Object film distance
    - c. Focal spot
  2. Materials unsharpness
    - a. Intensifying screens
    - b. Film
  3. Motion unsharpness
    - a. Voluntary
    - b. Involuntary

## **IV. Distortion**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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

### **CONTENT**

- A. Definition
- B. Types
  1. Shape
    - a. Foreshortening
    - b. Elongation
- C. Size (Magnification)
- D. Factors
  1. Distance
  2. Tube/part/film relationships

## V. Exposure Latitude

### OBJECTIVES

Following the completion of this unit, the student will:

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

### CONTENT

- A. Definition
- B. Factors
  1. kVp
  2. Intensifying screens
  3. Film

## **VI. Beam Limiting Devices**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. List the types of beam limiting devices and describe the operation and applications for each.
2. Explain purposes of beam limiting devices in terms of patient dosage, scattered radiation production, radiographic density, and contrast.

### **CONTENT**

- A. Definition
- B. Purposes
- C. Types
  1. Collimators
    - a. Function
    - b. Applications
  2. Apertures/diaphragms
    - a. Function
    - b. Applications
  3. Cones
    - a. Function
    - b. Applications
  4. Positive beam limitation (PBL)
    - a. Function
    - b. Applications



## **VII. Beam Filtration**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Define beam filtration.
2. Explain purposes of beam filtration in terms of patient dosage, scattered radiation production, radiographic density, and contrast.

### **CONTENT**

- A. Definition
- B. Rationale
- C. Composition
- D. Types
  1. Inherent
  2. Additional
  3. Total
  4. Compensatory
    - a. Construction
    - b. Applications
- E. Half Value Layer (HVL)
  1. Definition
  2. Applications

## VIII. Scattered/Secondary Radiation

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT

- 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

## IX. Control of the Remnant Beam

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT

- A. kVp Selection
- B. Grids
  1. Purpose
  2. Components
  3. Construction
    - a. Canting
    - b. Interspace material
  4. Types
    - a. Focused
    - b. Unfocused (parallel)
  5. Patterns
    - a. Linear
    - b. Cross hatch
  6. Terms/Definitions
    - a. Grid radius
    - b. Focal distance
    - c. Focal range
    - d. Convergent line
    - e. Convergent point
  7. Efficiency
    - a. Ratio
    - b. Frequency (lines/inch)
  8. Selection
    - a. kVp
    - b. Patient considerations
    - c. Distance
    - d. Beam alignment
    - e. Latitude
  9. Cut off
    - a. Definition
    - b. Factors
  10. Artifacts
- C. Beam Limitation

## **X. Technique Formation**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Explain the purpose of technique 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.

### **CONTENT**

- 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
- D. Application

## **XI. Exposure Calculations**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Analyze relationships of technique factors and their effects on 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.

### **CONTENT**

#### **A. Factors**

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

#### **B. Calculations**

1. Density/contrast
  - a. Photographic effect
  - b. Visual effect
2. Penumbra
  - a. Average gradient
  - b. Definition
3. Distortion
  - a. Magnification factor
  - b. Percent magnification
4. mAs reciprocity

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# IMAGING EQUIPMENT

## COURSE DESCRIPTION

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.

## COURSE OUTLINE

- I. Radiographic Equipment
- II. Image Intensified Fluoroscopy
- III. Recording Media and Techniques
- IV. Image Noise (Mottle)
- V. Other Imaging Equipment

# IMAGING EQUIPMENT

## I. Radiographic Equipment

### OBJECTIVES

Following the completion of this unit, the student will:

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.
5. Identify general radiation protection rules related to installation of new radiographic equipment.

### CONTENT

#### A. Permanent Installation

1. Types
2. Components
3. Purpose
4. Applications

#### B. Mobile Units

1. Types
2. Components
3. Purpose
4. Applications



## II. Image Intensified Fluoroscopy

### OBJECTIVES

Following the completion of this unit, the student will:

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 factors as related to intensification.
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 and brightness.
8. Discuss gain and conversion factors as related to intensification.

### CONTENT

- A. Definition
- B. Components
  1. Input phosphor
  2. Photocathode
  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<sup>1</sup>

Fluoroscopy by radiographers shall follow state statutes.

<sup>1</sup> 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 occur before this task is performed unsupervised.

### III. Recording Media and Techniques

#### OBJECTIVES

Following the completion of this unit, the student will:

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, 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, equipment and procedure (optional).
10. Discuss Polaroid in terms of purpose, equipment/film, and procedure.
11. Discuss conventional tomography in terms of purpose, principles, motions, equipment, and procedure.

#### CONTENT

- A. Video Tubes
  1. Purpose
  2. Construction
  3. Applications
- B. Video Recorders
  1. Purpose
  2. Construction
  3. Applications
- C. Strip Film Cameras
  1. Purpose
  2. Construction
  3. Applications
- D. Automatic Film Changers
  1. Purpose
  2. Types
    - a. Construction
    - b. Applications
- E. Duplication
  1. Purpose
  2. Equipment/film
  3. Procedure
- F. Subtraction
  1. Purpose
  2. Equipment/film
  3. Procedure
- G. Conventional Tomography

1. Purpose
2. Principles
3. Modes of travel
4. Equipment
5. Procedure

H. Image Enlargement

1. Purpose
2. Procedure

I. Stereoscopic Radiography

1. Purpose
2. Procedure

J. Polaroid

1. Purpose
2. Equipment/film
3. Procedure

Note: Areas H, I, and J are optional.

ASPT

## **IV. Image Noise (Mottle)**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

- A. Definition/Description
- B. Types
  1. Intensifier
    - a. Source
    - b. Relation to exposure
    - c. Relation to definition
    - d. Relation to contrast
    - e. Control
  2. Film
    - a. Source
    - b. Relation to exposure
    - c. Relation to definition
    - d. Relation to contrast
    - e. Control
  3. Image Noise (quantum mottle)
    - a. Source
    - b. Relation to exposure
    - c. Relation to definition
    - d. Relation to contrast
    - e. Control

## V. Specialized Imaging Equipment

### OBJECTIVES

Following the completion of this unit, the student will:

1. Discuss specialized imaging equipment in terms of its purpose, principles of operation, equipment and material required, and procedures.

### CONTENT

#### A. Computed Tomography

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

#### B. Digital Imaging

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

#### C. Magnetic Resonance Imaging

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

#### D. Xeroradiography

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

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# **RADIOGRAPHIC FILM PROCESSING**

## **COURSE DESCRIPTION**

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.

## **COURSE OUTLINE**

- I. Processing Area Considerations
- II. Handling and Storage of Film
- III. Characteristics of Films Utilized in Radiographic Procedures
- IV. Film Holders and Intensifying Screens
- V. The Automatic Processor
- VI. Artifacts
- VII. Silver Recovery



# RADIOGRAPHIC FILM PROCESSING

## I. Processing Area Considerations

### OBJECTIVES

Following the completion of this unit, the student will:

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 for both blue and green sensitive film emulsions.
3. Describe the operation and utilization of 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.

### CONTENT

#### A. Location/Construction/Function

1. Centralized/decentralized
  - a. Size
  - b. Location
  - c. Convenience
2. Day light processing
  - a. Function/operation
  - b. Purpose
3. Access
  - a. Maze
  - b. Rotex
  - c. Conventional
4. Staffing
  - a. Darkroom assistant
  - b. Technologists
5. Ease of operation
  - a. Layout
  - b. Counter height
  - c. Storage

#### B. Lighting

1. Safe light illumination
  - a. Definition
  - b. Filters
  - c. Bulb size/color
  - d. Testing
2. Warning lights
3. Day light processing
  - b. Location
  - c. Purpose
  - d. Function/operation

## II. Handling and Storage of Film

### OBJECTIVES

Following the completion of this unit, the student will:

1. Analyze the effects of the following on film in terms of processing considerations:
  - a. Temperature
  - b. Humidity
  - c. Light
  - d. Radiation
  - e. Handling
2. Analyze the effects of the following on film in terms of storage considerations:
  - a. Temperature
  - b. Humidity
  - c. Light
  - d. Radiation
  - e. Gases/fumes
  - f. Handling
  - g. Pressure
  - h. Expiration date

### CONTENT:

#### 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
  - a. Purchase considerations
  - b. Maximum storage time

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

#### OBJECTIVES

Following the completion of this unit, the student will:

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. Relate properties of radiographic film to specific procedure applications.
4. Define latent image formation.
5. Explain how sensitization specks contribute to latent image formation.
6. Define characteristic curve and explain its purpose.
7. Given density values, graph characteristic curves for radiographic film.
8. Given characteristic curves for radiographic film, interpret them.
9. Given characteristic curves for various radiographic film, analyze the curves and evaluate various films for specific procedures.

#### CONTENTS:

- A. Composition
  1. Components
  2. Structure
  3. Function
- B. Types
  1. Construction
  2. Applications
- C. Properties
  1. Contrast
    - a. Definition
    - b. Influence
    - c. Application
  2. Speed
    - a. Definition
    - b. Influence
    - c. Application
  3. Latitude
    - a. Definition
    - b. Influence
    - c. Application
  4. Recorded detail
    - a. Definition
    - b. Influence
    - c. Application
- D. Latent Image Formation
  1. Definition
  2. Sensitization specks
    - a. Definition
    - b. Location

c. Function

E. Characteristic Curve

1. Definition/purpose
2. Sensitometric equipment
3. Graphing
4. Interpretation
5. Curve construction and graphing
6. Evaluation

ASPT

## IV. Film Holders and Intensifying Screens

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT:

#### A. Film Holders

1. Cassettes
  - a. Purpose
  - b. Construction
  - c. Application
  - d. Loading/unloading
  - e. Maintenance
2. Disposable
  - a. Purpose
  - b. Construction
  - c. Application

#### B. Intensifying Screens

1. Purpose
2. Construction/composition
3. Principles of function
  - a. Fluorescence
  - b. Phosphorescence
  - c. Quantum noise
  - d. Film/screen contact
  - e. Technical influences
4. Classifications/applications
  - a. Phosphor
  - b. Speed
  - c. Patient dosage
5. Maintenance
  - a. Handling
  - b. Cleaning
  - c. Testing
  - d. Evaluation

## V. The Automatic Processor<sup>1</sup>

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT:

#### A. Unit

1. Purpose
2. Structure
  - a. Components
  - b. Function
3. Systems/functions
  - a. Chemical
  - b. Transport
  - c. Replenishment
  - d. Recirculation
  - e. Temperature control
  - f. Wash
  - g. Dry

#### B. Processing Cycle

1. Film feed
  - a. Sheet
  - b. Roll
2. Development
  - a. Action
  - b. Time
3. Fixer
  - a. Action
  - b. Time
4. Wash
  - a. Action
  - b. Time

5. Dry
  - a. Action
  - b. Time

6. Film exit

C. Maintenance/Cleaning

<sup>1</sup>Based on the state of the art, only automatic processing is included in this curriculum. If it is thought necessary or appropriate to teach manual processing techniques, previous editions of the ASRT Curriculum may be referenced.

ASRT

## **VI. Artifacts**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Define the term 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.

### **CONTENT:**

- A. Definition
- B. Types (To include cause, effects, and preventive methods)

ASRT



## VII. Silver Recovery

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENTS:

- A. Definition
- B. Rationale
- C. Methods
  1. Electrolytic
    - a. Process
    - b. Advantages
    - c. Disadvantages
  2. Metallic replacement/ion exchange
    - a. Process
    - b. Advantages
    - c. Disadvantages
  3. Discarded film
    - a. Unexposed
    - b. Exposed
- D. Security
  1. Control
  2. Theft
  3. Misappropriation

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# EVALUATION OF RADIOGRAPHS

## COURSE DESCRIPTION

Throughout the educational period, students should participate in regular, formal sessions for radiographic film evaluation. These sessions should be conducted under the supervision of the faculty. As the student progresses through the curriculum, the complexity of radiographs to be evaluated and the level of critique should increase.

## COURSE OUTLINE

- I. Evaluation of the Patient/Request for Radiographic Service
- II. Film Identification
- III. Positioning
- IV. Radiation Protection
- V. Variables Affecting Radiographic Quality

# EVALUATION OF RADIOGRAPHS

## I. Evaluation of the Patient/Request for Radiographic Service

### OBJECTIVES

Upon completion of the following five sections of this unit, the student will:

1. Identify the elements of thorough radiographic image evaluation.
2. Assess all the relevant criteria.
3. Demonstrate good judgement with regard to whether or not an image is optimal, diagnostic, or needs to be repeated.

### CONTENT

- A. Clinical Data
  1. Patient identification
  2. Age
  3. Sex
  4. History
- B. Procedure(s) To Be Performed
- C. Rationale for Radiographic Examination
  1. Clinical symptoms
  2. Disease process(es)
- D. Degree of Examination Difficulty
  1. Patient age
  2. Condition of patient
  3. Educational competency level of student

## **II. Film Identification**

### **CONTENT**

- A. Patient Information
- B. Date of Examination
- C. Procedure(s) Performed
- D. Area of Concern, Right or Left Side

ASPT

### **III. Positioning**

#### **CONTENT**

- 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

ASPT

## IV. Radiation Protection

### CONTENT

- A. Film Size
- B. Film/Screen Combination
- C. Collimation
- D. Shielding
- E. Repeats

ASPT

## V. Variables Affecting Radiographic Quality

### CONTENT

#### A. Density

1. mAs
2. kVp
3. SID (FFD)
4. Processing chemicals (time/temp-activity)
5. Patient factors (pathology, physique, etc)
6. Filtration
7. Anode/heel effect
8. Intensifying screens
9. Fog
10. Film
11. Beam restriction
12. Grid

#### B. Contrast

1. Beam restriction (lead blockers, cones, etc.)
2. Patient factors (pathology, physique, etc.)
3. kVp
4. mAs
5. Intensifying screens
6. Processing chemicals (time/temp-activity)
7. SID (FFD)
8. Compression
9. Fog
10. Grid
11. Film

#### C. Visibility

1. Density
2. Contrast
3. Fog
4. Processing
5. Film

#### D. Recorded Detail (Sharpness)

1. Motion
2. Film-screen contact
3. Intensifying screens
4. SID (FFD)
5. Focal spot size
6. OFD
7. Film



**E. Size Distortion**

1. OFD
2. SID (FFD)

**F. Anatomical Position**

1. Rotation
2. Improper alignment (body/tube)
3. Tilt (tipping or slanting to one side)
4. Appropriate film size
5. Appropriate marker placement
6. Appropriate collimation

**G. Shape Distortion**

1. Central ray-part-receptor (film) alignment
  - a. Central ray alignment
  - b. Part alignment
  - c. Film alignment
2. Centering
  - a. Too far medial
  - b. Too far lateral
  - c. Too far superior
  - d. Too far inferior
3. Central ray direction (tube angulation)
  - a. Too steep of an angle
  - b. Too shallow of an angle
  - c. Angled the wrong direction

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# RADIATION PHYSICS

## COURSE DESCRIPTION

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.

## COURSE OUTLINE

- I. Units of Measurement
- II. General Principles
- III. Structure of the Atom
- IV. Structure of Matter
- V. Electromagnetic Radiation
- VI. Electrostatics
- VII. Magnetism
- VIII. Electrodynamics
- IX. Electromagnetism
- X. Rectification
- XI. X-Ray Tubes
- XII. X-Ray Circuit
- XIII. Production and Characteristics of Radiation

# RADIATION PHYSICS

## I. Unit of Measurements

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT

#### A. Fundamental Units

1. Length
2. Mass
3. Time
4. Temperature

#### B. Derived Units

1. Area
2. Volume
3. Density
4. Specific gravity
5. Velocity

#### C. Systems of Measurement

1. English
2. Metric

## II. General Principles

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT

- 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

### III. Structure of the Atom

#### OBJECTIVES

Following the completion of this unit, the student will:

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

#### CONTENT

##### A. Nucleus

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

##### B. Electron Shells

1. Components
2. Arrangements
  - a. Binding energy
  - b. Movement
  - c. Ionization

##### C. Nomenclature

1. Atomic number
2. Mass number
3. Isotope
4. Isobar
5. Isomer
6. Isotone
7. Ion

## IV. Structure of Matter

### OBJECTIVES

Following the completion of this unit, the student will:

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

### CONTENT

#### A. Elements

1. Definition
2. Periodic Table

#### B. Compound

1. Definition
2. Molecule

#### C. Radioactivity

1. Radiation
  - a. Electromagnetic
  - b. Particulate
2. Half-life
3. Units
  - a. Curie (Ci)
  - b. Becquerel (Bq)

## V. Electromagnetic Radiation

### OBJECTIVES

Following the completion of this unit, the student will:

1. Describe the nature of light.
2. Define and describe wavelength and frequency and how they are related to velocity.
3. Describe the electromagnetic spectrum.
4. Explain the relation of energy and frequency with Planck's Constant.

### CONTENT

#### A. Nature of Light

1. Speed of light
2. Wavelength
3. Frequency

#### B. Electromagnetic Spectrum

1. Types of electromagnetic radiation
2. X and gamma rays
  - a. Energy
  - b. Planck's constant



## **VI. Electrostatics**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

- 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

## VII. Magnetism

### OBJECTIVES

Following the completion of this unit, the student will:

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 the list of materials, classify according to magnetic characteristics.

### CONTENT

#### 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

## VIII. Electromagnetism

### OBJECTIVES

Following the completion of this unit, the student will:

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 resolve 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.

### CONTENT

#### A. Moving Charges

1. Potential differences
2. Current
  - a. Direct
  - b. Alternating
3. Resistance
4. Circuit

#### B. Measuring Devices

1. Galvanometer
2. Ammeter
3. Voltmeter

#### C. Protective Devices

1. Fuse
2. Ground
3. Circuit Breaker

## **IX. Electromagnetism**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

- A. Interaction Between Electric/Magnetic Fields
- B. Induction
  1. Self
  2. Mutual
- C. Applications
  1. Generators
    - a. Types
    - b. Function
  2. Motors
    - a. Types
    - b. Function
  3. Transformers
    - a. Types
    - b. Function
  4. Coils
    - a. Types
    - b. Function

## **X. Rectification**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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

### **CONTENT**

- A. Definition
- B. Purpose
- C. Devices
  1. Solid state
    - a. Function
    - b. Advantages/disadvantages
  2. Vacuum tubes
    - a. Function
    - b. Advantages/disadvantages

## **XI. X-Ray Tubes**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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 exposures factor, use an anode cooling chart to determine the anode cooling rate.
8. Given simulated exposures and a cooling chart determine heat units and cooling characteristics of x-ray tube housings.

### **CONTENT**

#### **A. Construction**

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

#### **B. Thermal Capacity**

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

## XII. X-Ray Circuits

### OBJECTIVES

Following the completion of this unit, the student will:

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.

### CONTENT

- A. Primary Circuit
  1. Components
  2. Function
- B. Secondary Circuit
  1. Components
  2. Function
- C. Filament Circuit
  1. Components
  2. Function

## **XIII. Production and Characteristics of Radiation**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. State the principles 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 photodisintegration.
6. Discuss relationships of wavelength and frequency to beam characteristics.
7. Define units of radiation measurement and provide an example of radiology application.

### **CONTENT**

- A. X-ray Production
  1. Principle
  2. Processes
    - a. Bremsstrahlung
    - b. Characteristic
  3. Necessary conditions
    - a. Source
    - b. Acceleration
    - c. Deceleration
- B. Interactions of X-ray with Matter
  1. Photoelectric effect
    - a. Description of interaction
    - b. Relation to atomic number
    - c. Application
  2. Compton scattering
    - a. Description of interaction
    - b. Relation to atomic number
    - c. Application
  3. Unmodified scattering (coherent)
    - a. Description of interaction
    - b. Relation to atomic number
    - c. Application
  4. Pair production
    - a. Description of interaction
    - b. Relation to atomic number
    - c. Application
  5. Photodisintegration
- 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

ASPT

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# **PRINCIPLES OF RADIATION PROTECTION**

## **COURSE DESCRIPTION**

This unit will provide the student with an overview of the principles of radiation protection. Radiation protection responsibilities of the radiographer for patients, personnel, and the public is presented. The concepts of As Low As Reasonably Achievable (ALARA), Negligible Individual Risk Level (NIRL), and stochastic and nonstochastic effects will be discussed and compared with the concept of Maximum Permissible Dose (MPD). Regulatory agencies will be identified and agency involvement in radiation protection will be discussed.

## **COURSE OUTLINE**

- I. Introduction
- II. Radiation Detection and Measurement
- III. Patient Protection
- IV. Personnel Protection
- V. Radiation Dose - Limiting Standards
- VI. Agencies and Regulations

# PRINCIPLES OF RADIATION PROTECTION

## I. Introduction

### OBJECTIVES

Following the completion of this unit, the student will:

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

### CONTENT

#### 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

## II. Radiation Detection and Measurement

### OBJECTIVES

Following the completion of this unit, the student will:

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

### CONTENT

#### A. Units (SI Unit Compared With Traditional Unit)

1. Coulomb/kilogram (Roentgen)
2. Gray (rad)
3. Sievert (rem)
4. Becquerel (Curie)

#### B. Personnel Monitoring Devices

1. Film badge
  - a. Area to be worn during -
    1. Routine procedures
    2. Fluoroscopic procedures
    3. Mobile radiographic procedures
  - b. Components of the badge
  - c. Reports
  - d. Usage guidelines
2. Thermoluminescent dosimeter
  - a. Components
  - b. Advantages and disadvantages
3. Pocket ionization chamber (pocket dosimeters)
  - a. Components
  - b. Advantages/disadvantages

#### C. Instruments - Principles/Applications

1. Radiation survey instrument requirements
2. Ionization chambers
  - a. Cutie pie
  - b. Purpose
  - c. Advantages for use
  - d. Disadvantages for use
3. Geiger-Mueller detector
  - a. Principle
  - b. Applications
  - c. Purpose
  - d. Advantages for use
  - e. Disadvantages for use

4. Calibration instruments
  - a. Victoreen Condensor R-meter
    1. Measurement
    2. Purpose

ASPT

### III. Patient Protection

#### OBJECTIVES

Following the completion of this unit, the student will:

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.
9. Discuss the importance of clear, concise instructions (effective communication skills) as a method of radiation protection.
10. Discuss the effect(s) of immobilization techniques to eliminate voluntary motion.
11. Describe the minimum source-to-tabletop distances for fixed and mobile fluoroscopes.
12. Discuss safety factors for the patient (and other patients) in the room during mobile radiographic procedures.

#### CONTENT

- A. Effective Communication (Radiographer and Patient)
- B. Beam Limiting Devices
  - 1. Collimators
  - 2. Cones
  - 3. Diaphragms
- C. Filtration
- D. Shielding (gonadal)
  - 1. Flat contact shields
  - 2. Shadow shields
  - 3. Shaped contact shields
- E. Ten Day Rule
- F. Exposure Factors
- G. Film/Screen Combinations
- H. Repeat Radiographers
  - 1. Motion
  - 2. Radiographic processing
  - 3. Carelessness or poor judgement
- I. Immobilization
- J. Fluoroscopic Procedures
- K. Mobile Radiography

## **IV. Personnel Protection**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

- A. Room Construction/Design
  1. Walls
  2. Windows
  3. Doors
  4. Control booth
- B. Radiologic Equipment/Technique
  1. Distance
  2. Beam limiting
  3. Exposure control cord length
  4. Protective tube housing
- C. Personnel Protective Devices
  1. Apron
  2. Gloves
  3. Movable shields
  4. Protective drape or sliding panel (fluoroscopic)
  5. Bucky slot shielding device (fluoroscopic)
  6. Cumulative timing device (fluoroscopic)
- D. Patient Restraint Devices



## V. Radiation Dose - Limiting Standards

### OBJECTIVES

Following the completion of this unit, the student will:

1. Define the terms ALARA (optimization), NIRL, stochastic and nonstochastic effects.
2. Using the NCRP recommendation for occupational workers, list the dose limit for various ages.
3. Discuss and state the dose limit for the general public (nonoccupational) and for an embryo/fetus.

### CONTENT

- A. Definition of Terms
  1. ALARA (optimization)
  2. NIRL
  3. Stochastic effects
  4. Nonstochastic effects
- B. Rationale for the Elimination of former Guidelines for Maximum Permissible Cose (MPD)
- C. Goal of Radiation Protection
- D. Basis for Occupational Exposure Limits: Comparable Risk
- E. Effective Dose Equivalent Limit: Occupational (NCRP Recommendation)
  1. Annual effective dose equivalent of 50 mSv (5 rem)
  2. Cumulative limit
    - a. No greater than age (years) times 10 mSv (1 rem). This is not intended to permit exposures in excess of the annual limit of 50 mSv (5 rem)
- F. Protection of the Embryo-Fetus (NCRP)

## **VI. Agencies and Regulations**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Identify federal and state regulatory agencies.
2. Discuss regulations influencing radiation protection.
3. Discuss the recommendations made in the NCRP Report No. 91.

### **CONTENT**

#### **A. Agencies**

1. Federal
2. State

#### **B. Regulations**

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

#### **C. Recommendations**

1. NCRP Report No. 91
  - a. Recommendations on limits for exposure to ionizing radiation

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# PRINCIPLES OF RADIATION BIOLOGY

## COURSE DESCRIPTION

This unit will provide the student with an overview of the principles of the interaction of radiation with the living systems. Radiation effects on biological molecules and organisms and factors affecting biological response are presented. Acute and chronic effects of radiation are discussed.

## COURSE OUTLINE

- I. Radiation Chemistry
- II. Radiation Biochemistry
- III. Cellular Radiation Effects
- IV. Systemic Effects and Syndromes
- V. Genetic Effects
- VI. Somatic Effects
- VII. Population Effects

# PRINCIPLES OF RADIATION BIOLOGY

## I. Radiation Chemistry

### OBJECTIVES

Following the completion of this unit, the student will:

1. Discuss radiation effects on atoms and molecules.
2. Describe the radiochemistry of water.
3. Define linear energy transfer.

### CONTENT

- A. Aqueous Solution
- B. Simple Molecules
- C. Linear Energy Transfer

## **II. Radiation Biochemistry**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Explain the structure and function of biomolecules.
2. Describe radiation effects on important biomolecules.

### **CONTENT**

- A. Lipids
- B. Carbohydrates
- C. Proteins
- D. Nucleic acids

ASPRE

### **III. Cellular Radiation Effects**

#### **OBJECTIVES**

Following the completion of this unit, the student will:

1. List cellular organelles.
2. Describe radiation effects on the cell.
3. Describe radiation effects on cell division.
4. Explain differences in cellular radiosensitivity.

#### **CONTENT**

- A. Cellular organelles
- B. Cell division
- C. Cell sensitivity

ASPRE

## **IV. Systemic Effects and Syndromes**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Describe whole-body radiation effects.
2. Explain the cause of systemic symptoms.
3. Describe fetal effects in terms of systemic radiosensitivity.

### **CONTENT**

- A. Hematopoietic
- B. Gastrointestinal
- C. Central Nervous System
- D. Fetal Effects



## **V. Genetic Effects**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Explain radiation mutation.
2. Describe types of radiation genetic lesions.

### **CONTENT**

- A. The Concept of Mutation
- B. Radiation Mutagenesis

ASPRE

## **VI. Somatic Effects**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Describe radiation mutagenesis.
2. Explain radiation carcinogenesis.
3. List radiation-induced cancers.

### **CONTENT**

- A. Mutagenesis
- B. Carcinogenesis

ASPRE

## **VII. Population Effects**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Identify natural sources of radiation exposure.
2. Describe exposures and doses in diagnostic radiology, therapeutic radiology, and nuclear medicine.

### **CONTENT**

- A. Sources of Exposure
- B. Diagnostic Radiology
- C. Therapeutic Radiology
- D. Nuclear Medicine

ASRT

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# **RADIOGRAPHIC PATHOLOGY**

## **COURSE DESCRIPTION**

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.

## **COURSE OUTLINE**

- I. Introduction to Pathology
- II. Trauma/Physical Injury
- III. Systemic Classifications of Disease
- IV. Repair and Replacement of Tissue

# RADIOGRAPHIC PATHOLOGY

## I. Introduction to Pathology

### OBJECTIVES

Following the completion of this unit, the student will:

1. Define terms related to pathology.
2. Discuss manifestations of pathological conditions and their relevance to radiographic procedures.

### CONTENT

#### A. Definitions

1. Pathology
2. Disease
  - a. Acute
  - b. Chronic
3. Pathogenesis
4. Etiology
5. Trauma
6. Syndrome
7. Diagnosis
  - a. Signs (objective)
  - b. Symptoms (subjective)
8. Prognosis

#### B. Purpose of Study

1. Manifestations of pathology
2. Relevance to radiographic procedures

## II. Trauma/Physical Injury

### OBJECTIVES

Following the completion of this unit, the student will:

1. List the classifications of trauma and define each.
2. Describe examples/sites, complications, and prognosis for classifications of trauma.
3. Discuss radiographic diagnosis for classifications of trauma.

### CONTENT

- A. Definition
- B. Classifications
  - 1. Mechanical
    - a. Definition
    - b. Examples/sites
    - c. Complications
    - d. Prognosis
  - 2. Chemical
    - a. Definition
    - b. Examples/sites
    - c. Complications
    - d. Prognosis
  - 3. Thermal
    - a. Definition
    - b. Examples/sites
    - c. Complications
    - d. Prognosis
  - 4. Radiation
    - a. Definition
    - b. Examples/sites
    - c. Complications
    - d. Prognosis
  - 5. Other
    - a. Definition
    - b. Examples/sites
    - c. Complications
    - d. Prognosis
- C. Radiographic Diagnosis

### **III. Systemic Classifications of Disease**

#### **OBJECTIVES**

Following the completion of this unit, the student will:

1. List the systemic classifications of disease and define each.
2. For each of the systemic classifications of disease, describe etiology, examples and sites, complications and prognosis.
3. Describe radiographic procedures and techniques appropriate for different examples of diseases in each of the systemic classifications.

#### **CONTENT**

##### **A. Skeletal/Articular**

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

##### **B. Muscular**

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

##### **C. Digestive**

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

##### **D. Respiratory**

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

##### **E. Urinary**

1. Definition
2. Etiology
3. Examples/sites
4. Complications



5. Prognosis
6. Radiographic procedures
7. Effects on radiographic technique

F. Reproductive

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

G. Circulatory

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

H. Reticuloendothelial

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

I. Endocrine

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

J. Nervous

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

K. Sensor Organs

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

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## **IV. Repair and Replacement of Tissue**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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

### **CONTENT**

#### **A. Causes**

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

- B. The Healing Process
- C. Complications

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# INTRODUCTION TO QUALITY ASSURANCE

## COURSE DESCRIPTION

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.

## COURSE OUTLINE

- I. Quality Assurance Concepts
- II. State and Federal Regulations
- III. Monitoring and Maintenance

# INTRODUCTION TO QUALITY ASSURANCE

## I. Quality Assurance Concepts

### OBJECTIVES

Following the completion of this unit, the student will:

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.
4. Discuss the importance of continuing education in regard to the rapid advancement of technology.

### CONTENT

#### A. Definitions

1. Quality assurance
2. Quality control

#### B. Benefits

1. Patient
  - a. Reduction in radiation exposure
  - b. Efficacy of patient care
2. Departmental
  - a. Consistency in production of quality diagnostic images
  - b. 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
9. Continuing education

## **II. State and Federal Regulations**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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.

### **CONTENT**

#### **A. State**

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

#### **B. Federal**

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

### III. Monitoring and Maintenance

#### OBJECTIVES

Following the completion of this unit, the student will:

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 preventive and corrective maintenance for components of the radiography system.
5. Define reject analysis and describe objectives of a reject analysis program.
6. Explain the procedure, evaluation, and follow-up for a retake analysis program.
7. Given the necessary equipment, perform the quality control tests presented in this unit.

#### CONTENT

##### A. Responsibility

1. Radiographer
2. Quality control/quality assurance technologists
3. Physicist
4. Service engineer
5. Radiologist

##### B. Components of Radiographic System

1. Radiographic units
  - a. Test material/equipment
  - b. Test procedures
  - c. Evaluation/interpretation
  - d. Preventive maintenance
  - e. Corrective maintenance
2. Fluoroscopic units
  - a. Test material/equipment
  - b. Test procedures
  - c. Evaluation/interpretation
  - d. Preventive maintenance
  - e. Corrective maintenance
3. Tomographic units
  - a. Test material/equipment
  - b. Test procedures
  - c. Evaluation/interpretation
  - d. Preventive maintenance
  - e. Corrective maintenance



4. Processors/darkrooms
    - a. Test material/equipment
    - b. Test procedures
    - c. Evaluation/interpretation
    - d. Preventive maintenance
    - e. Corrective maintenance
  5. Illuminators
    - a. Test material/equipment
    - b. Test procedures
    - c. Evaluation/interpretation
    - d. Preventive maintenance
    - e. Corrective maintenance
  6. Cassettes/intensifying screens
    - a. Test material/equipment
    - b. Test procedures
    - c. Evaluation/interpretation
    - d. Preventive maintenance
    - e. Corrective maintenance
  7. Grids
    - a. Test material/equipment
    - b. Test procedures
    - c. Evaluation/interpretation
    - d. Preventive maintenance
    - e. Corrective maintenance
  8. Protective devices
    - a. Test material/equipment
    - b. Test procedures
    - c. Evaluation/interpretation
    - d. Preventive maintenance
    - e. Corrective maintenance
- C. Retake Analysis
1. Definition
  2. Objective
  3. Procedure
  4. Evaluation
  5. Follow-up

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# COMPUTER APPLICATIONS IN RADIOLOGY

## COURSE DESCRIPTION

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 discussed.

## COURSE OUTLINE

- I. History
- II. Fundamentals
- III. Components
- IV. Operations
- V. Computer Applications in Radiology

# COMPUTER APPLICATIONS IN RADIOLOGY

## I. History

### OBJECTIVE

Following the completion of this unit, the student will:

1. Discuss the history of computers.

### CONTENT

- A. Abacus
- B. Mechanical
- C. Electric
- D. Electronic

ASPT

## **II. Fundamentals**

### **OBJECTIVES**

Following the completion of this unit, the student will:

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

### **CONTENT**

- A. Terminology
- B. Types of computers
  1. General purpose/mainframe
  2. Minicomputer
  3. Microcomputer

### III. Components

#### OBJECTIVES

Following the completion of this unit, the student will:

1. Define various terms related to components of computers.
2. List major functions of CPU.
3. Given a list of input/output devices, differentiate among them.
4. Define memory and describe the types.
5. Describe the care and preventive maintenance for the computer system.

#### CONTENT

- A. Terminology
- B. Central Processing Unit (CPU)
  1. Arithmetic logic unit (ALU)
  2. Control unit (CU)
  3. Internal memory
- C. Input/Output Devices (I/O) (Peripherals)
  1. Input
    - a. Punch card
    - b. Punch paper tape
    - c. Keyboards
    - d. Video terminals
    - e. The mouse
    - f. The light pen
    - g. Voice entry
    - h. Digitizing cameras
    - i. Image scanner
  2. Output
    - a. Printers and plotters
    - b. Cathode ray tube (CRT) - terminal
    - c. Graphic displays
    - d. Voice output microform
    - e. Computer output microform
- D. Primary Memory/Secondary Data Storage
  1. Primary memory
    - a. Random access memory (RAM)
    - b. Read only memory (ROM)
  2. Secondary storage
    - a. Floppy disks
    - b. Hard disks
    - c. Tape
- E. Computer Care and Maintenance
  1. Computer catastrophes
  2. Computer environment
  3. Preventive maintenance

## IV. Operation

### OBJECTIVES

Following the completion of this unit, the student will:

1. Define various terms related to computer operation.
2. Discuss analog to digital conversion, distinguish between analog computers and digital computers.
3. Explain the binary function.
4. Define programming and describe its purpose.
5. Compare and contrast various programming languages.
6. Discuss application of various types of software.

### CONTENT

- A. Terminology
- B. Analog Computers
- C. Digital Computers
- D. Binary Computers
- E. Programming

1. Definition
2. Purpose
3. Languages
  - a. MUMPS
  - b. ALGOL
  - c. APL
  - d. BASIC
  - e. COBOL
  - f. FORTRAN
  - g. PASCAL
  - h. PL/1
4. Software
  - a. Word processors
  - b. Data base
  - c. Spread sheet
  - d. Desktop publishers
  - e. Graphics
  - f. Integrated application programs

## **V. Computer Applications in Radiology**

### **OBJECTIVES**

Following the completion of this unit, the student will:

1. Identify various types of computer imaging in radiology (these techniques are fully described under Imaging Equipment or specialized curricular areas.)

### **CONTENT**

#### **A. Imaging**

1. Computed tomography (CT)
2. Digital radiology
3. Magnetic Resonance Imaging (MRI) hardware and software
4. Nuclear medicine applications
5. Radiation therapy treatment planning
6. Ultrasound applications



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# VENIPUNCTURE

## Course Description

This unit will provide the student with the theory and practice of the basic techniques of venipuncture and the administration of contrast media and/or intravenous medication.

## Course Outline

- I. Contrast Media/Intravenous Medication
- II. Venous Anatomy
- III. Preparation: Room/Patient
- IV. Administration/Venipuncture
- V. Vital Signs
- VI. Complications/Reactions

It is recommended that patient care (with CPR Certification), the circulatory system and pharmacology be satisfactorily completed prior to the start of this unit.

# VENIPUNCTURE

## I. CONTRAST MEDIA/Intravenous MEDICATION

### Objectives

Following the completion of this section, the student will:

1. Define contrast media.
2. Differentiate between ionic and non-ionic contrast media.
3. Identify the common medications used in the Radiology Department.
4. Define the pharmacology of the common medications used in the Radiology Department.
5. Identify the indications for the use of contrast media and pertinent medications.
6. Describe the contraindications for contrast media and pertinent medications.
7. State the common dosage for contrast media and pertinent medications.
8. Prepare, for injection, contrast media/intravenous medication, utilizing aseptic technique.

### Content

- A. Definitions:
  1. Contrast media
    - a. ionic
    - b. non-ionic
- B. Indications/Contraindications
- C. Dosage
- D. Preparation

## **II. VENOUS SYSTEM ANATOMY**

### **Objectives**

Following the completion of this section, the student will:

1. Demonstrate knowledge of the circulatory system.
2. Identify and locate the veins most commonly used for upper extremity venipuncture.

### **Content**

- A. Upper Extremity Venous Anatomy
- B. Most Common Venipuncture Sites

ASPT

### **III. PREPARATION: ROOM/PATIENT**

#### **Objectives**

Following the completion of this section, the student will:

1. State the location of the closest Code/Crash Cart.
2. State the location of the closest oxygen and suction equipment.
3. Prepare those items necessary for venipuncture to include, but not limited to, tourniquet, needles/butterflies, tape, gauze, arm board, bandaids and contrast media/intravenous medication.
4. Identify the appropriate method of proper patient identification for the proper examination.
5. Obtain an allergic history, if any, from the patient.
6. Explain to the patient, in its entirety, the examination to be performed.

#### **Content**

##### **A. Room Equipment**

1. Code/crash cart
  - a. oxygen
  - b. suction
2. Venipuncture equipment
  - a. tourniquet
  - b. needles/butterflies
  - c. alcohol wipes/betadine
  - d. tape
  - e. gauze
  - f. arm board
  - g. bandaids

##### **B. Patient Preparation**

1. Proper examination identification
2. Proper patient identification
3. Patient allergic history
4. Examination explanation

## **IV. Administration/Venipuncture**

### **Objectives**

Following the completion of this section, the student will:

1. Practice Universal Precautions.
2. Select and prepare an appropriate site for venipuncture.
3. Apply the tourniquet at the selected site.
4. Cleanse the site with an antiseptic.
5. Insert the needle and ascertain proper venous backflow.
6. Inject, at the proper rate, the proper contrast media/intravenous medication, or connect the proper drip infusion contrast media/intravenous medication.
7. Observe the site for infiltration or extravasation.
8. Observe the patient for reactions.
9. Upon completion of the injection, withdraw the needle and apply pressure to the site.

### **Content**

- A. Universal Precautions
- B. Site Preparation
- C. Tourniquet
- D. Cleansing of Site
- E. Needle Insertion
- F. Injection/Release of Tourniquet
- G. Patient Observation
- H. Needle Withdrawal
- I. Site Pressure

Though regulations regarding the administration of contrast media and intravenous medications vary in different states and institutions, the official position of the American Society of Radiologic Technologists is that venipuncture falls within the profession's general scope of practice and that it therefore shall be included in the didactic curriculum of all appropriate disciplines and competencies demonstrated regardless of the state or institution where such curriculum is taught.

## **V. VITAL SIGNS**

### **Objectives**

Following the completion of this section, the student will:

1. State the normal values for pulse, respiration, blood pressure, oxygen therapy and heart monitoring.
2. Perform, monitor and record pulse, respiration, blood pressure and oxygen therapy on a patient.

### **Content**

- A. Pulse
- B. Respiration
- C. Blood Pressure
- D. Oxygen Therapy
- E. Heart Monitoring

ASPRE



## **VI. COMPLICATIONS/REACTIONS**

### **Objectives**

Following the completion of this section, the student will:

1. Identify and define the possible complications/reactions of a contrast media/intravenous medication.
2. Know and be able to respond appropriately to either a complication/reaction to a contrast media or IV medication.
3. Respond appropriately to a complication/reaction during, or after, the administration of a contrast media or intravenous medication.
4. Document the administration of a contrast media or intravenous medication.
5. Document a complication/reaction to contrast media or intravenous medication.

### **Content**

- A. Patient Observation
- B. Patient Management
- C. Documentation

