At the end of this unit, the student radiographer should be able to:

1. State the **Inverse Square Law and Square Law**.
2. Discuss tips for estimating SID.
3. List the Abbreviations known for this chapter’s topic.
4. Practice working with Inverse Square Law formula.
5. Describe the effect of SID on **Sharpness of Recorded Detail**.
6. Describe the effect of SID on **Magnification**.
7. Discuss SID’s effect on Shape Distortion of the radiographic image.
8. Describe the effect of SID on **Density**.
9. Discuss the rules of thumb for distance changes.
10. Describe the effect of SID on **CONTRAST**.
11. Define the following terms:

   Ratio  penumbra  Inversely Proportional
   SOD

Reading assignment:  PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 255-269

Instructional method:  Lecture & teacher information
   Handouts
   Written assignment
   Discussion
   Role playing
   Use of powered lab and darkroom
At the end of this unit, the student radiographer should:

1. Identify the factors most affected by OID.
2. Discuss the effects of OID on sharpness of recorded detail.
3. Discuss the effect of OID on magnification.
4. Explain the effect of OID on shape distortion.
5. Explain how an object’s distance can affect image contrast and density.
6. Discuss fully, the air gap technique.
7. Answer chapter review questions.
8. Define the following pertinent terminology:

Air gap technique  emitter  scatter rays

Diverge  recognizability factor

Reading assignment:  PRACTICAL RADIOGRAPHIC IMAGING 8th ed.;  
Carrol,Quinn B.,pp. 270-276

Instructional method:  Lecture & teacher information
  Handouts
  Written assignment
  Discussion
  Role playing
  Use of powered lab and darkroom
RADR 2309 --- Chapter 20

Distance Ratios

At the end of this unit, the student radiographer should:

1. Identify the factors needed to determine distance ratios.
2. Define *Similar Triangle Geometry*.
3. Diagram *Similar Triangle Geometry* for magnification.
4. Explain the SID/OID ratio and formula as it pertains to magnification.
5. Explain the SID/OID ratio and formula as it pertains to sharpness of the image.
6. Demonstrate the geometric *UNSHARPNESS* formula.
7. Explain the steps in *macroradiography*.
8. Define the following pertinent terminology:
9. Solve for *Magnification Ratios* (ex.17)

Geometric qualities (of the image) relative geometric sharpness

Visibility functions

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 277-282

Instructional method: Lecture & teacher information
   Handouts
   Written assignment
   Discussion
   Role playing
   Use of powered lab and darkroom
At the end of this unit, the student radiographer should:

1. Identify the equipment (parts) involved in this phase of alignment.
2. Discuss the effects of the orientation of the x-ray beam geometrical integrity.
3. Compare and contrast “off-centering to angling”.
4. Explain the effect of B-P-F alignment on shape distortion.
5. Discuss the 4 major factors affecting shape distortion of the image.
7. Discuss the relationship between B-P-F alignment and Density.
8. State the rule of thumb for maintaining density, when compensating for angulation of the beam.
9. Define the following pertinent terminology:

   Foreshortening     elongation     distortion     off-centering
   Isometric angle

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 283-293

Instructional method: Lecture & teacher information
   Handouts
   Written assignment
   Discussion
   Role playing
   Use of powered lab and darkroom
At the end of this unit, the student radiographer should:

1. State the objectives for specific positioning.
2. Discuss the projection routines for several exams.
3. List projection routines as you have encountered them at your clinical sites.
4. Define the following pertinent terminology:

   Standardized projections  
   right angles

Reading assignment:  PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 294-295.

Instructional method:  Lecture & teacher information
   Handouts
   Written assignment
   Discussion
   Role playing
   Use of powered lab and darkroom
RADR 2309 --- Chapter 23

Motion

At the end of this unit, the student radiographer should:

1. Discuss the effect of motion on image sharpness.
2. Discuss the effect of motion on image contrast.
3. Discuss any effect of motion on image density.
4. Describe image noise and motion’s effect (if any).
5. Discuss the relationship magnification and distortion with regard to motion.
6. Define the following pertinent terminology:

   Immobilization          voluntary motion          involuntary motion

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 296-301.

Instructional method: Lecture & teacher information
                      Handouts
                      Written assignment
                      Discussion
                      Role playing
                      Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. State the factors affecting radiographic density.
2. Discuss the factors in item #1.
3. State the factors affecting radiographic contrast.
4. Discuss the factors in item #3.
5. Describe some of the causes of image noise.
6. Discuss the factors affecting magnification and distortion.
7. Complete Ex. #19
8. Define the following terms:

<table>
<thead>
<tr>
<th>Image RESOLUTION</th>
<th>edge gradient</th>
<th>MTF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total penumbra</td>
<td>spatial frequency</td>
<td>absorption penumbra</td>
</tr>
<tr>
<td>Acutance</td>
<td>parallax blur</td>
<td>density trace diagram</td>
</tr>
</tbody>
</table>

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; CARROLL, QUINN B., pp. 305-326.

Instructional method: Lecture & teacher information
Handouts
Written assignment
Discussion
Role playing
Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. Discuss a “beautiful” radiograph in comparison to a “good quality” film.
2. Describe the CRITERIA for obtaining satisfactory radiographic quality.
3. Define “OPTIMUM” (fixed) kilovoltage technique.
4. List the phases involved in the standardization of radiography.
5. Describe the role of thickness ranges in producing a quality radiograph.
6. Define “OPTIMUM” mA.
7. Compare OVEREXPOSURE and UNDEREXPOSURE.
8. Discuss the use of variable kilovoltage techniques.
9. Define the following terms:

   Uniformity consistency


Instructional method: Lecture & teacher information
   Handouts
   Written assignment
   Discussion
   Role playing
   Use of powered lab and darkroom
At the end of this unit, the student radiographer should:

1. Identify groupings of anatomical parts requiring approximately the same total technique.
2. Derive techniques using the proportional anatomy system.
3. Discuss “optimum kVp” for anatomy already learned.
4. Practice using the 15% rule.
5. Discuss patient body habitus in relationship to a proportional anatomy system.
6. Compare technique for average adult torso to that of different age groups.
7. Apply the proportional anatomy system.
8. Define the following pertinent terminology:

   Total technique   key derivation references

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 337-347.

Instructional method: Lecture & teacher information
Handouts
Written assignment
Discussion
Role playing
Use of powered lab and darkroom
RADR 2309 --- Chapter 27

Technique Charts

At the end of this unit, the student radiographer should:

1. Describe a “technique chart”.
2. Discuss how these charts have been proven to reduce patient exposure.
3. Identify some types of quality control measures which make using the charts possible.
4. Formulate your own technique chart as done in class.
5. Demonstrate the use of calipers.
6. Define the following pertinent terminology:

   “Extremity cassette”              systematic approach
   Periodic                            calipers
   AEC

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 348-359.

Instructional method: Lecture & teacher information
   Handouts
   Written assignment
   Discussion
   Role playing
   Use of powered lab and darkroom
At the end of this unit, the student radiographer should:

1. Define *phototimers*.
2. Discuss the need for setting a “back-up time” when using AEC.
3. Compare and contrast density control by numbers or symbols to actual body size.
4. Explain the limitations of AEC.
5. Discuss the uses of *detector cells* on different types of anatomy.
6. Discuss the use of AEC technique charts.
7. Define the following pertinent terminology:

   - Photomultiplier tube
   - *thyristor*  
   - MRT

   - Back-up time
   - *peripheral* anatomy

   - Detector/Sensor cells

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 360-382.
Instructional method: Lecture & teacher information
   - Handouts
   - Written assignment
   - Discussion
   - Role playing
   - Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. Discuss the **main objective** of radiographic technique.
2. Describe how **mAs is related** to patient exposure.
3. Describe how **kVp is related** to patient exposure.
4. Discuss and compare the effect of different machines on patient exposure.
5. Explain **field size limitation** and how **YOU can limit** patient exposure.
6. Employ information about techniques to produce minimum exposure in powered lab.
7. Discuss Fluoro and Mobile procedures in reference to **patient dose**.
8. Gather information (from “repeat” bin) for quality control check (next chapter).
9. Define the following terms:

Filtration          QC          exposure rate

Reading assignment:  PRACTICAL RADIOGRAPHIC IMAGING 8th ed.;
Carrol, Quinn B., pp. 383-389.

Instructional method:  Lecture & teacher information
                      Handouts
                      Written assignment
                      Discussion
                      Role playing
                      Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. Discuss average repeat rates for different departments.
2. Describe how exposure timers are checked for accuracy.
3. Discuss the use of a Wisconsin kVp test cassette.
4. Define optical attenuator.
5. Explain the set-up of a repeat analysis log (table 30-3&30-4).
6. Perform light field alignment quality control test in classroom lab.
7. Define the following terms:
   
   calibration       monitoring       sensitometry
   continuing education repeat analysis obtrusiveness
   linearity         reproducibility HVL
   blooming effect   NCRP

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol,Quinn B., pp. 390-419.

Instructional method: Lecture & teacher information
Handouts
Written assignment
Discussion
Role playing
Use of powered lab and darkroom
Solving Multiple Technique Problems

At the end of this unit, the student radiographer should:

1. Discuss factors involved in solving for greatest density technique.
2. Discuss factors involved in solving for greatest contrast technique.
3. Discuss factors involved in solving for greatest recorded detail technique.
4. Apply the methods discussed, mathematically and logically, to solve problems.
5. Define the following pertinent terminology:

   Density value  skin dose  quantified
   Potential      exposure values

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 420-425
Instructional method: Lecture & teacher information
Handouts
Written assignment
Discussion
Role playing
Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. List the variables which may be involved in mobile radiography.
2. Compare efficiency of different types of mobile units to standard machines (generators).
3. Discuss “selection” of mAs and kVp when using mobile units.
4. Describe geometrical factors and distance considerations in performing mobile radiography.
5. Discuss alignment and positioning factors which may influence our decisions during mobile radiography.
6. Explain how techniques may be derived and manipulated when performing mobile studies.
7. Define the following terms:

   Technique  wafer grid  mobile generators


Instructional method: Lecture & teacher information
   Handouts
   Written assignment
   Discussion
   Role playing
   Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. Discuss “depth perception” as relates to the human eye.
3. Describe “Fluoroscopic Parallax”.
4. Discuss LASER IMAGING and its components.
5. List some of the movement patterns used in tomography.
6. Discuss the use of XERORADIOGRAPHY.
7. Discuss all review questions at end of chapter.
8. Define the following terms:

   Parallactic shift       tomography       fulcrum point
   Focal plane             exposure arc     amplitude     false images
   Selectivity             annular artifacts focal depth   hypocycloidal


Instructional method: Lecture & teacher information
Handouts
Written assignment
Discussion
Role playing
Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. Define **Fluoroscopy**.
2. Describe the *electronic* properties of an *image intensifier*.
3. Discuss the different methods of recording *fluoroscopic* images.
4. Discuss the effects of “brightness controls” on the image.
5. Describe fluoroscopic image quality and the factors which affect it.
6. Describe *magnification* in relationship to fluoro images.
7. Describe *distortion* in relationship to fluoro images.
8. Compare and contrast “C-arm” fluoroscopy and fluoro in the department.
9. Define the following terms:

   **ABS v. AGC**  beam splitting  Image intensifier
   TV monitor  “spot film”  vignetting
   Cine  input/output phosphors  dynamic

Reading assignment:  **PRACTICAL RADIOGRAPHIC IMAGING 8th ed.**; Carrol, Quinn B., pp. 446-465.

Instructional method:  Lecture & teacher information
Handouts
Written assignment
Discussion
Role playing
Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. Discuss the “nature” of images.
2. Describe hardware.
3. Define software.
4. Diagram the functional organization of the four components which make up a computer.
5. List the steps involved in **digitizing** any image.
6. Discuss the major components of an image processing system.
7. Discuss digital imaging applications in radiology.
8. Compare the use of digital imaging in *CT* with that of *MRI*.
9. Describe Digital **teleradiology**.
10. Define the following terms:

**Digital imaging**  **analog image**  **ADC**  **3-D imaging**

**DAC**  **CRT**  **matrix**  **RAM**  **LASER**

**ROM**  **quantization**  **PACS**

**Digital fluoro**  **PSPDR**

Reading assignment:  *PRACTICAL RADIOGRAPHIC IMAGING* 8th ed.; Carrol, Quinn B., pp. 466-494.

Instructional method:  Lecture & teacher information
Handouts
Written assignment
Discussion
Role playing
Use of powered lab and darkroom
At the end of this unit, the student radiographer should be able to:

1. Describe how images are created in Digital Radiography.
2. List the benefits of a digital imaging system.
3. Describe the three requirements of the medical imaging process.
4. Name the “greatest” factor that limits departments from becoming totally filmless.
5. Define photostimulable phosphor plate.
6. Describe the effect of pixel size on the sharpness of an image.
7. Compare contrast resolution abilities to the contrast qualities of a conventional radiograph.
8. Discuss PROCESSING of digital images.
9. Outline the functions of a digital work station.
10. Define the following terms:

   “slices”     DR     CR     attenuation coefficient     voxel
   Spatial resolution     FOV     SFOV     DRC     quantization
   Edge enhancement     PSP     Windowing     equalization

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 495-518.

Instructional method: Lecture & teacher information
                  Handouts
                  Written assignment
                  Discussion
                  Role playing
                  Use of powered lab and darkroom
RADR 2309----- Chapter 37
Digital Processing Applications

PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carroll, Quinn B., pp.521-544

TBA---some will be deferred to second year

RADR 2309----- Chapter 38
Practical Applications for CR

PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carroll, Quinn B., pp.545-570

TBA--- some will be deferred to second year
At the end of this unit, the student radiographer should be able to:

1. List the steps involved in radiographic film processing.
2. Describe the steps involved in radiographic film processing.
3. List the constituents of the developer solution.
4. Discuss the processes of reduction and oxidation as they relate to processing chemicals.
5. List the fixer constituents.
6. Discuss the influence of TIME on development.
7. Discuss the influence of SOLUTION TEMPERATURE on development.
8. List some methods of compensating for temperature changes.
9. Discuss the effect of solution concentration on the development process.
10. Describe the fixing process.
11. Discuss the effects of solution temperature, time and concentration of the fixer solution.
12. Report the types of image qualities affected by development variables.

11. Define the following terms:

- Clearing action
- hardening action
- chemical fog
- PQ developer
- MQ developer
- replenisher
- Solvent
- “all italicized terms/chemicals”

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 571-578.

Instructional method: Lecture & teacher information
- Handouts
- Written assignment
- Discussion
- Role playing
- Use of powered lab and darkroom
RADR 2309--- Chapter 40

Automatic Processors

At the end of this unit, the student radiographer should:

1. Discuss the history of fully automatic processing systems.
2. Compare and contrast manual processing factors to those of automatic systems.
3. Describe the transport system and its components.
4. Explain the function of the circulation /filtration system.
5. Explain the function of the tempering system.
6. Describe the replenishment system of the automatic processor.
7. List the components of the dryer system.
8. Describe a technologist’s role in processor maintenance.
9. Identify different processing artifacts given pertinent radiographs.
10. Answer all chapter review questions.
11. Define the following pertinent terminology:

   phenidone  gluteraldehyde  feed rack  deep racks
   solar and planetary rollers  squeegee  crossover racks
   dryer rollers  Pi lines  hesitation marks  reticulation

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carroll, Quinn B., pp. 579-595.
Instructional method: Lecture & teacher information
   Handouts
   Written assignment
   Discussion
   Role playing
   Use of powered lab and darkroom
Film Handling and Duplication Procedures

At the end of this unit, the student radiographer should:

1. Identify the purpose of **SAFETY film** used today.
2. Discuss the conditions by which film is packed and stored.
3. Compare **darkroom construction** and situation to that of other rooms in the department.
4. Explain the effects of mishandling x-ray film.
5. Discuss the different types of lighting employed in the darkroom.
6. Discuss the loading and unloading of film, including identification.
7. Identify the components of a *daylight* processing system.
8. Discuss the steps involved in DUPLICATION and SUBTRACTION.
9. List the steps involved in the SILVER RECOVERY process.
10. Define the following pertinent terminology:

   *Solarization* duplication subtraction mask

   *Safelights* artifacts

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B. pp. 596-603.
Instructional method: Lecture & teacher information
  - Handouts
  - Written assignment
  - Discussion
  - Role playing
  - Use of powered lab and darkroom
RADR 2309--- Chapter 42

Sensitometric Quality Control

At the end of this unit, the student radiographer should:

1. Define and describe Sensitometry.
2. Recognize the H and D curve and its usefulness in comparing IR systems as well as processing variables.
3. Demonstrate how H and D curves are derived from step wedge radiographic images (fig. 41-2 and 41-3).
4. Discuss the reasons for having Radiologic QUALITY CONTROL.

12. Define the following pertinent terminology:

H and D curve Processing control charts

Toe, body and shoulder of curves

Reading assignment: PRACTICAL RADIOGRAPHIC IMAGING 8th ed.; Carrol, Quinn B., pp. 604-612.

Instructional method: Lecture & teacher information
Handouts
Written assignment
Discussion
Role playing
Use of powered lab and darkroom

Reviewed/Revised: 1/2013vya