DI 230 Basic Principles of Computed Tomography

LBCC Diagnostic Imaging Program
Summer 2022

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COURSE DESCRIPTION
This course is designed to establish a knowledge base in Computed Tomography (CT). This class is a one credit hour course designed around cross-sectional anatomy and computed tomography equipment.

ONLINE MODULE
CT Basics Modules

OPTIONAL SUPPLEMENTAL TEXTS
- Radiologic Science for Technologists, Stewart Bushong, 10th edition, Computed Tomography Chapter

ASRT COURSE OBJECTIVES
- Describe the components of the CT imaging system
- Differentiate between conventional and spiral/helical CT scanning
- Explain the functions of collimators in CT
- List the CT computer data processing steps
- Name the functions of the array processor used for image reconstruction
- Define the term "algorithm" and explain its impact on image scan factors and reconstruction
- Define the terms "raw data" and "image data"
- Explain the difference between reconstructing and reformatting an image
- Describe the application of the following terms to CT:
    - Pixel
    - Matrix
    - Voxel
    - Linear attenuation coefficient
    - CT/Hounsfield number
    - Partial volume averaging
    - Window width (ww) and window level (wl)
    - Spatial resolution
    - Contrast resolution
    - Noise
    - Annotation
    - Region of interest (ROI)
    - Standard vs. volumetric data acquisition
- Name the common controls found on CT operator consoles and describe how and why each is used
- Identify the types and appearance of artifacts most commonly affecting CT images
- Explain how artifacts can be reduced or eliminated
- List and describe current data storage techniques used in CT
- Name the radiation protection devices that can be used to reduce patient dose in CT and describe the correct application of each

LBCC COURSE OUTCOMES:

- Describe the components and the data acquisition process of the CT imaging system.
- Explain the procedural requirements for basic CT scans including the general purpose of commonly performed CT studies.
- Identify and describe anatomical structures within various planes of a CT image.

CONTACTING THE INSTRUCTOR

Email is the best way to contact the instructor for this class. Emails received between Monday at 8am and Friday at 5pm are generally returned within 24 hours. Emails received on Saturdays, Sundays, or holidays will be returned on the next business day.

ONLINE RESOURCES/LINKS

This hybrid online course contains many links. A concerted effort is made to ensure all materials are accessible. However, if you discover a link to be broken or missing, please email the instructor to let her know which link is broken/non-functional and where it is located so the problem may be remedied.

STUDENT EXPECTATIONS

- **YOU are RESPONSIBLE for your own LEARNING.**
- **We provide the structure for that learning, but it is up to you to decide how much or little you get out of the class.**
- **Each student is expected to spend time studying on his/her own.**
- **There are specific deadlines, so this course is not self-paced. It is up to the student to keep up with his/her assignments and deadlines.**
- **No late work is ever accepted.**
- ***Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Single Stop Office for support (SinglestopatLBCC@linnbenton.edu , 541-917- 4877, or visit us on the web www.linnbenton.edu under student services for current students). Our office can help students get connected to resources to help. Furthermore, please notify the professor if you are comfortable in doing so. This will enable them to provide any resources that they may possess.***

COURSE OUTLINE:

WEEK	DATES	TOPIC	READING REQUIREMENT	HOMEWORK	ASSIGNMENT	ASSESSMENT
1	6/25- 7/3	Fundamentals	Fundamentals	HW 1	Permission	Quiz 1

			Optional reading: Computed Tomography Ch. in Bushong		Assignment **(due by 11:59 pm 7/3)**	**(due by 11:59pm 7/3)**
2	7/2-7/10	Equipment and Instrumentation	Equipment & Instrumentation *Optional reading: Computed Tomography Ch. in Bushong*	HW 2		Quiz 2 **(due by 11:59 pm 7/10)**
3	7/9-7/17	Cross-Sectional Anatomy: Head and Neck	Cross-Sectional Anatomy Head & Neck Brain Anatomy	HW 3		Quiz 3 **(due by 11:59 pm 7/17**
4	7/16 - 7/24	Data Acquisition	Data Acquisition *Supplemental:* Excerpts from Bushong and Seeram	HW 4	DISCUSSION BOARD POST #1 **(due by 11:59 pm 7/24)**	Quiz 4 **(due by 11:59 pm 7/24)**
5	7/23 -7/31	Image Processing and Reconstruction	Image Processing and Reconstruction	HW 5	DISCUSSION BOARD POST #2 **(due by 11:59 pm 7/31)**	Quiz 5 **(due by 11:59 pm 7/31)**
6	7/30 -8/7	Cross-Sectional Anatomy: Chest/ Abdomen/ Pelvis	Cross-Sectional Chest, Abdomen, Pelvis Chest Anatomy	HW 6		Quiz 6 **(due by 11:59 pm 8/7)**
7	8/6 - 8/14	Patient Safety	Patient Safety in CT *Supplemental:* Excerpt: *Radiation Dose in Computed Tomography* by B. Furlow	HW 7	DISCUSSION BOARD POST #3 **(due by 11:59 pm 8/14)**	Quiz 7 **(due by 11:59 pm 8/14)**

8	8/13 - 8/21	Image Quality	Image Quality *Supplemental:* Excerpt from Bushong	HW 8	DISCUSSION BOARD POST #4 **(due by 11:59 pm 8/21)**	Quiz 8 **(due by 11:59 pm 8/21)**
9	8/20- 8/28	Patient Procedures and Additional Applications FINALS WEEK	CT Procedures Additional Applications	HW 9	**FINAL EXAM (due by Sunday 8/28 at 11:59 p.m.)**	Quiz 9 **(due by 11:59 pm 8/29)** **FINAL EXAM (due by Sunday 8/28 at 11:59 p.m.)**

ASSIGNMENTS
Students will be required to view online ASRT modules and/or complete weekly reading assignments, submit online ungraded homework, take weekly graded critical thinking assessments, obtain permission from the clinical coordinator to observe four different types of CT exams and then report your observations on the discussion board, submit three Webliography assignments, and complete other assignments/projects as given. A written final exam is also a large portion of the grade. Assignments must be completed/submitted by the due date in order to be graded. Late work is not accepted.

READING REQUIREMENT
Weekly reading requirements consist of online, interactive modules developed by the ASRT over each week's topic for students to review. Please make sure the volume is turned up on your computer so you may hear the instruction that goes along with each slide. If you wish to read the transcript, click the "cc" button in the bottom right-hand side of the screen.

Please note: the ASRT modules **may not be compatible with Macintosh computers**. If you are a Mac user and are trying to play the module, you will most likely have difficulty. Most students need to find a PC on which to run these modules in order to successfully view them.

We understand some students might also prefer an actual, physical book from which to highlight and review. In an effort to address the learning style of those types of learners, additional reading assignments that correlate to the CT modules will be also assigned. For example, for both Modules 1 and 2, the chapter for Computed Tomography in Bushong addresses the material. The supplemental assigned chapters in Bushong are not meant to take the place of the ASRT modules; these are assigned to help further your understanding. It is essential that you take the time to go through the assigned ASRT modules in order to meet each module's learning objectives.

HOMEWORK (9 HW @ 0 points each)
There will be weekly *ungraded* homework for students to use as a study tool. **You must complete the homework with a 70% or higher in order to unlock the quizzes.** The homework allows the student to determine how well they understand the material and is provided as an additional study resource for the critical thinking assessments and for the final exam. Homework will be made available online within the Moodle class Saturday mornings at 12:00 am the week it is assigned and is ideally completed by the following Sunday night at 11:59 pm, although there is technically no deadline with homework. Homework may be completed and submitted multiple times. Make sure to "submit" each time you take it or you will be locked out. The homework is provided as "practice". They will allow almost instantaneous feedback, so that students may see if there are specific areas that need additional

study/review. Students will have access to online homework questions for topics covered in class. The material covered in the homework can come from the ASRT modules, textbooks, lectures, homework, and any other included activities.The homework may be completed using whatever resources are available.

PERMISSION ASSIGNMENT/ OBSERVATION OF CT EXAMS/ DISCUSSION BOARD POSTS (45 POINTS)
As part of this course, we would like for you to observe four different types of CT exams and then share your observations and questions about the exams on a discussion board.

1) Obtaining Permission (1 email @ 5 points)
The first week of class, please talk with your clinical coordinator. Show them your syllabus and explain that as part of your class you have been asked to observe four different CT exams during the course of the term:

- Head and/or neck
- Chest
- Abdomen and/or pelvis
- Extremity (upper or lower)

Ask your clinical coordinator for permission to observe these four types of exams during the term. Please note that a certain amount of time observing is *not* required, but rather just observing four different types of exams. Once you have permission, email your instructor a short note stating you may observe in CT, and the name of the person who gave you that permission. Please make note of any conditions surrounding your observations that your mentor may have set for you (e.g., only on four specific Fridays for 30 minutes or CT will call you when an exam comes in, etc.)

If your clinical coordinator does not feel it will be possible for you to observe these four types of exams during the course of the term, please still email your instructor and provide us with any relevant information about why this might not be possible so we may explore other options to help you meet this requirement.

This assignment is due by 11:59 p.m. on Sunday. Late work is not accepted.

2) Observations (4 observations @ 0 points each)
During the course of the term, observe each of the four different types of exams and make notes of the following:

a) Exam observed, date and time

b) Type of CT scanner (Manufacturer, number of slices, etc.)

c) Ask the tech if there was anything they had to do once the *order was received* (Contact the ordering physician? Why? Verify patient lab work? Which labs? Why?)

d) What the tech did to prepare the *room* for the exam (What supplies were pulled? Why? How was the patient table/couch configured? Which direction will the patient's head/feet go?

e) What the tech did to prepare the *patient* for the exam (Explanation given? Was contrast given? If so, what kind? How was the contrast administered? How long prior to the exam was the contrast given?)

f) What happened *during the exam* (How was the patient positioned? Was the patient prone? Supine? Were there any breathing/other instructions given to the patient? How long did it take? Was the patient shielded? Why/why not?)

g) What happened *after the exam* (Was the patient given any special aftercare instructions? What

did the tech do to clean/prepare the room for the next patient? What kind of paperwork did the tech have to do? Did the tech talk with a radiologist or the ordering physician about the exam?)

h) Were any *changes made to the images* after the exam was complete (Was any software used to manipulate or change the images, or configure the anatomy into a 3-D image?)

i) Any *pathology* noted by the technologist/radiologist (if no pathology was noted, please state this)

j) *At least one question* you have about the exam or what you observed

It is expected you will include information on each of the points above, but don't consider them to be the only things you need to pay attention to. Please include any additional information you feel helps to best describe what you observed during your time in CT.

3) Discussion Board POSTS (4 posts @ 10 points each = 40 points)

You will be required to post to the **CT class discussion board** four times during the term, and also reply to four other student posts. Please note there are four specific deadlines. Please do not post all of your discussions at once, but wait until each post opens within the module. **NOTE: You will not be able to post your first discussion board discussion until Module 4 unlocks. This is the first week the discussion posts are due. If you would like to get your write up done sooner, type your question in a word or google doc and save it until the Module unlocks.**

- July 24 (Discussion post and response #1)
- July 31 (Discussion post and response #2)
- August 14 (Discussion post and response #3)
- August 21 (Discussion post and response #4)

If you do not make your first post by the deadline, your assignment will be considered "late" and you will earn a zero for Discussion Post.

There is no particular order in which you must observe/report on the exams. If you happen to observe an extremity first, and a head a few weeks later, a chest a week after that, and finally a pelvis, that's fine. Just make sure to post your description of what you observed under the correct discussion thread (i.e., observations of a knee CT would go under the "Extremity CT" thread and not the "Chest CT" or "Abdomen/Pelvis CT" threads). What *is* important is making sure you have **observed one of the four CT exams** by the discussion board **deadlines** and then **posting your observations and comments/question**s to your peers.

Quizzes (9 Quizzes @ 5-20 points each = ~ 120 POINTS)
There are nine scheduled quizzes throughout the term consisting of up to 20 questions each. They may contain multiple-choice, true/false, fill-in-the-blank, short answer, matching and/or essay questions. Quizzes are available to be completed beginning at 12:00am on Saturday mornings. You have until the following Sunday night at 11:59pm to submit them. Quizzes are **closed note/book** and may only be taken **once**. All students are expected to take Quizzes with **integrity**, jeopardizing neither their own work, nor that of others.

In an effort to try and help you study for the Quizzes and the Final, it is suggested you look at and study the following resources:

1) The ASRT objectives listed for each module
2) The ASRT reading modules listed under reading requirement

3) Definitions and vocabulary
4) Cross sectional anatomy
5) Homework questions

As we go through the CT modules, the material listed above will all be covered. Quizzes will concentrate on the big picture of the ASRT objectives and modules, cross-sectional anatomy and definitions. If by the end of the course, you can answer questions prompted by the ASRT objectives, ASRT reading modules and define the important words and terms, then you will be successful on the final exam.

FINAL EXAM (100 points)
The final exam will be comprehensive and will consist of 50 ARRT-type multiple choice questions. Each question will be worth two points each. The homework questions will help you study for the final. **The closed note, closed book exam will be available to take online during the week of August 21-29, and must be completed no later than 11:59 pm on Sunday, August 29th. It is expected all students will take the final exam with integrity.**

GRADING SCALE:

A = 91.5 - 100%
B = 82.5 - 91.4%
C = 74.5 - 82.4%
FAIL = < 74.5% Less than 74.5% will result in the student being withdrawn from the program and receiving a letter grade of F on their transcripts.

Syllabus Change Policy
Syllabus is subject to change as the instructor evaluates the progress of students and their understanding of concepts.

Course Failure Policy
If a student fails this course, he or she must withdraw from the program.

Discrimination Policy

LBCC prohibits unlawful discrimination based on race, color, religion, ethnicity, use of native language, national origin, sex, sexual orientation, marital status, disability, veteran status, age, or any other status protected under applicable federal, state, or local laws. For further information, visit this link.

Disability Services Policy

You should meet with your instructor during the first week of class if
- You have a documented disability and need accommodations,
- Your instructor needs to know medical information about you, or
- You need special arrangements in the event of an emergency.

If you have not accessed services and think you may need them, please contact Disability Services, 541-917-4789.

Statement of Inclusion
The LBCC community is enriched by diversity. Everyone has the right to think, learn, and work together in an environment of respect, tolerance, and goodwill. I actively support this right regardless of race, creed, color, personal opinion, gender, sexual orientation, or any of the countless other ways in which we are diverse. (related to

Board Policy #1015)

Single Stop at LBCC:

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is to visit us on the web www.linnbenton.edu under student services for current students. Our office can help students get connected to resources to help. Furthermore, please notify the professor if you are comfortable in doing so. This will enable them to provide any resources that they may possess.