TEXAS CHIROPRACTIC COLLEGE SPRING 2012 TRIMESTER

COURSE NUMBER AND NAME: **PHYSICS PRINCIPLES OF DIAGNOSTIC IMAGING – DI-3220**
COURSE MEETING – DAYS / TIME: **WEDNESDAY: 12:00 – 1:00 PM AND THURSDAY 8:00-9:00AM**
COURSE MEETING PLACE: **LRC 203**
COURSE HOURS: **2 LECTURE**
COURSE CREDITS: **2**

COURSE INSTRUCTOR: **JEFFREY R. THOMPSON, DC**
CONTACT INFORMATION: **OFFICE PHONE- (281) 998-6071** JTHOMPSON@TXCHIRO.EDU
OFFICE NUMBER AND BUILDING:SMITH BLDG.
OFFICE HOURS – DAYS / TIME: **BY APPOINTMENT-**
OFFICE HOURS ARE BY APPOINTMENT THROUGH MS. PAM VISE (EXT. 6056) OR CAN BE SCHEDULED WITH DR THOMPSON DIRECTLY VIA EMAIL OR BEFORE/AFTER CLASS.

WEBSITE: Edvance 360 Address: http://edvance360.com/txchiro

COURSE MATERIALS

REQUIRED TEXTS:

- **BUSHONG, SC: RADIOLOGIC SCIENCE FOR TECHNOLOGISTS: PHYSICS, BIOLOGY AND** PROTECTION MOSBY PUBLISHERS (CURRENT EDITION – 9TH), PUB. 2009.ISBN 10: 0323048374 / 0-323-04837-4
- OTHER REFERENCES:**TEXAS DEPARTMENT OF HEALTH, BUREAU OF RADIATION CONTROL: TEXAS REGULATIONS FOR CONTROL OF RADIATION TRCR 289.227 AND 289.231.**

COURSE DESCRIPTION

This course is designed to give the chiropractic student a clinical working knowledge of the physics, radiobiology, technical principles, and issues of radiation safety/protections pertaining to the use of ionizing radiation in diagnostic imaging.

PRE-REQUISITES:

- Gross anatomy & embryology I, Spinal Anatomy

.LEARNING OUTCOMES

- The student will recognize the components of an x-ray imaging system .
- The student will be able to recognize and describe the interaction of important physical principles that are at work in the production and the use of x- rays for diagnostic imaging.

- The student will understand how the principles of x- ray physics and radiation safety are applied during the operation of x-ray imaging devices to achieve the best image quality at the lowest patient dose.
- The student will appreciate the importance and application of safety procedures in the utilization of ionizing radiation.

CCE COMPETENCIES

- The following CCE competencies are addressed in this course:
  - Diagnostic Studies
  - Neuromusculoskeletal examination.

Diagnostic Studies:

LEARNING OBJECTIVES: THE STUDENT WILL BE ABLE TO -

- Recognize the fundamental units of radiation exposure and dose.
- Recognize the fundamental units of electricity and their application in the production of x-rays.
- Identify the physical principles of x- ray production for the purposes of diagnostic imaging
- Describe the important waveform characteristics of electromagnetic radiation and their inter-relation.
- List the basic components of an x-ray machine and explain their purpose/function.
- Recognize the important types of atomic-level interactions that may occur between x-ray photons and matter including the production of scatter radiation.
- Recall the basic structure of x-ray film and x-ray intensifying screens and describe their function in creation of the latent image.
- Recall and identify the basic chemical interactions that occur in x-ray film processing.
- Compare and contrast basic principles of analog x-ray image production versus digital imaging.
- Demonstrate the ability to recall and identify operator controlled variables of diagnostic x- ray imaging, including mA, kVp, exposure time and source-to-image distance.
- Identify resulting image qualityeffects that occur in response to changes in operator controlled x-ray exposure variablesand explain how the interaction of these principles affects image quality and safety.
- Explain the interactions between functional components of a diagnostic x- ray machine and recognize the role that each plays in the safe utilization of diagnostic x- ray.
- Identify and explain the use of equipment, exposure factors and other technical means of limiting the amount of scatter radiation generated.
- Analyze the role of x- ray technique variables, film exposure and processing procedures in the production of quality x- ray images
- Identify the role of source-object distance, source-image distance, object position and other geometric factors in diagnostic image distortion and magnification.
- Identify and explain the effect that ionizing radiation has on living tissues/organisms and the attendant risks involved in the use of ionizing radiation for diagnostic imaging.
- Describe necessary steps to avoid common technical errors in x-ray exposure technique selection and equipment handling

- ❖ Recognizethe risk models and risk estimates involved in the exposure of humans to ionizing radiation for diagnostic imaging.
- ❖ Recognize the early and late effects of human exposure to ionizing radiation.
- ❖ Describe the risks and possible effects of in utero radiation
- ❖ Recognize the principlesof radiobiology and radiation safety and the application of these principles in the safe operation of plain film x- ray imaging devices.

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TEACHING PHILOSOPHY:

Lectures for Principles of X-ray Physics will be a didactic presentation of PowerPoint lectures and Edvance 360 information with regular classroom opportunity for questions and discussion. An important role of the instructor is to facilitate the efficient student achievement of goals/objectives by selecting and emphasizingpertinent topics fromthe required text. The student is expected to keep current on their understanding of course material, reviewing notes from the previous class and reading related areas in the course textbook. It is expected that the student will both take and review class notes, and carefully read those related topics in the textbook to assure complete understanding of the material. This will prepare the student to understand and participate in a brief question/answer review at the beginning of each class that will cover the previously presented material. Questions from students during class regarding presented material are expected and welcomed. Regular attendance and attention are required.

Topical Sequence Guideline - X-ray Physics Principles

Chapters listed below are from required text Radiologic Science for Technologists 9th edition

NOTE: this is not a comprehensive topical list of all material covered in this class; this guideline will, however, assist the student in coordinating material presented in lectures with corresponding topics in the text. Both the sequence and content are subject to modification during the trimester. It remains the responsibility of the student to coordinate textbook reading with topical presentations in class. Timing and material included for the intra-term exams are also subject to adjustment as necessary

- WEEK 1 : Chapt 1 – 3 (Review and history)
  - Historical perspective
  - Basic physics review
  - Special units of radiation quantification
  - Atomic structure
  - Ionization

- WEEK 2 : Chapt 4 -5
  - Electromagnetic radiation
  - X-ray properties, terminology
  - Electricity- units and principles

- WEEK 3 : Chapt 6 – 7
  - X-ray machine- components
  - X-ray tube construction

- WEEK 4 : Chapt 8-9

- X-ray beam production
- X-ray beam spectrum, attenuation and HVL

INTERTERM EXAM

- WEEK 5: Chapt 15 Radiographic Technique

- WEEK 6: Chapt 10-11
  - X-ray interactions with matter
  - X-ray film

- WEEK 7: Chapt 12-13
  - X-ray film processing
  - X-ray screens
- WEEK 8: Chapt 14
  - Control of scatter- grids

INTERTERM EXAM

- WEEK 9: Chapt 16, 32-33
  - Image Quality
  - Biology review

- WEEK 10 : Chapt 33 -35
  - Radiobiology
  - Radiation exposure- Acute (early) effects
  - EXAM

- WEEK 11 Chapt 35- 36
  - Radiation exposure- Chronic (late) effects

- WEEK 12 Chapt 37-38 Radiation protection/ safety

- WEEK 13 Chapt 39-40 Dose management/ safety

- WEEK 14- **Final examination**

GRADE METHOD AND SCALE:

- **TCC GRADE SCALE:** **A (90% – 100%)**

  B (80% – 89%)

  C (70% – 79%)

  F (<70%)

❖ **FINAL GRADE BREAKDOWN:**

- There will be a 2 Intra-term exams and a final exam, in addition to 2 or more quizzes. **Examinations will be cumulative**. Grades will be weighted as follows:
  - Intra-term Written Exams- 2 (Avg exam scores = 40% of course grade)
  - Final Written Exam (comprehensive) (50% of course grade)
  - Quiz grades (avg) (10% of course grade)

NOTE: There is **no opportunity for individual "extra credit"**
Quizzes will be announced.<u>All examinations are comprehensive</u>. Unexcused absences from a quiz or exam will result in a Zero grade for that evaluation.

❖ **ASSESSMENT FORMAT:**

- Multiple choice, matching, extended matching, T/F and short answer questions may be used.

COURSE POLICY INFORMATION

For further information on how each policies are enforced see the Student Handbook.

❖ **ATTENDANCE:** As per college policy. Absences of 20% or more of total class hours (2hrs x 13 weeks = 5 absences) will result in a failing grade. Absences in excess of 10% may result in lowering of grade. Refer to the student handbook for more information.

❖ **CLASS PARTICIPATION:** All students will be required to participate in classdiscussions/interactions.

❖ **SEATING:** Assigned seating will be arranged by the instructor- you will be expected to be in your assigned seat during class.

❖ **MISSED EXAMS OR ASSIGNMENTS:**

- Any exam or assignment that is missed will be recorded as a zero grade percentage. Re-exams or postponement of midterm or final exams will be granted for students who present written proof of a personal medical emergency or severe illness/death of a family member. In the case of conflicting exams, written documentation from the registrar is required to postpone your exam. Make-up midterm exams must be completed as per college policy (see paragraph below). Make-up exams may be given in an essay style format.

- Make-up policy is in accordance with TCC policy, abbreviated below (for complete statement, see TCC Make-up Exam Policy as revised May 27, 2009 and cabinet approved July 2009)
- <u>Missed exam Policy (abbreviated)</u>:

Students must notify faculty before missing any examination. If an examination is missed for good and sufficient reason and the student has notified the faculty member in advance, a make-up

examination may be given subject to a fee of $40.00. The fee for the make-up examination is a minimum of $75.00 if a standardized patient is required for the exam. Additional required standardized patient hours may increase this $75.00 minimum fee. All intra-term examination must be made up prior to final examinations. Missed final examinations must be made up within the first week of the next semester. A student may be allowed a maximum of two missed examination dates for good and sufficient reason per trimester. These two missed examination dates are for all enrolled courses in a trimester, not for each individual course. Any request for additional make-up examinations will require documentation substantiating the absence and must be approved by the Dean of Academic Affairs.

- **REVIEW OF EXAMINATIONS:**
  - Students may review their examinations by appointment with the instructor. Scheduling is best accomplished directly with the instructor (email or before/after class), however Coordinating Secretary, Ms. Pam Vise (ext. 6056) can also be contacted in the Smith Bldg. for assistance in scheduling.
  - **Exams must be reviewed within 2 weeks (10 working days) of the time the grades are posted for that exam.** In the case of the final exam, the student may review the exam after finals week during the break (pending instructor schedule) or the first two weeks of the next trimester.

- **ACADEMIC DISHONESTY:** Academic integrity is expected at all times, as per college policy. Refer to the student handbook for more information. Be aware that any "old exams" from this class are stolen material and you may be subject to academic discipline or dismissal if found in possession.

- **USE OF ELECTRONIC DEVICES**:

  - **NOTE**: THE OPPORTUNITY TO USE ELECTRONIC DEVICES IN THE CLASSROOM CAN BE IMMEDIATELY SUSPENDED IF A STUDENT IS IN VIOLATION OF THIS POLICY.

  - NO ELECTRONIC DEVICES MAY BE USED DURING ANY FORM OF EXAMINATION OR ASSESSMENT.

  - DISTRACTING OR DISRUPTIVE USE OF ANY ELECTRONIC DEVICE IS NOT PERMITTED DURING CLASS PERIODS.
    - DISTRACTING OR DISRUPTIVE USE WILL INCLUDE BUT NOT BE LIMITED TO EXAMPLES BELOW.
      - CELL PHONES: STUDENTS MAY NOT USE THEIR CELL PHONES DURING CLASSES OR EXAMS- NOT FOR CALLS, NOT FOR TEXTING, NOT FOR LIGHT, NOT FOR PICTURES, NOT FOR ANYTHING. IF YOU ARE EXPECTING AN IMPORTANT CALL DURING A CLASS (NOT AN EXAM), PUT YOUR PHONE ON SILENT ALARM, SIT NEAR THE DOOR AND STEP OUTSIDE THE CLASSROOM TO TAKE THE CALL. YOU MAY (QUIETLY) RE-ENTER THE CLASSROOM AFTER YOU FINISH THE CALL.
      - PERSONAL COMPUTERS: YOU MAY USE YOUR COMPUTER TO TAKE NOTES DURING CLASS. COMPUTERS WILL BE OFF DURING EXAMINATIONS. YOU MAY NOT USE IT FOR ANY FORM OF PERSONAL COMMUNICATION OR ENTERTAINMENT DURING CLASS.

- OTHER DEVICES: PRIOR TO USE, THE USE OF ANY OTHER ELECTRONIC RECORDING OR COMMUNICATION DEVICE IN THE CLASSROOM MUST BE SPECIFICALLY APPROVED BY THE INSTRUCTOR.

❖ **TUTORING:** As per college policy. Refer to the student handbook for moreinformation.

❖ **LEARNING DISABILITIES/IMPAIRMENTS:**

- Those students who may require additional time or other special accommodations for testing due to learning disability must contact the TCC Counseling Dept. **at the beginning of the trimester** in order to allow sufficient time for arrangements to be made. The presence of a disability (diagnosis alone is insufficient) must be confirmed by the Counseling Dept. before any modification of standard testing protocols/procedures will be offered.
- To ensure the validity of any request, no accommodation for special testing circumstances will be made without prior review and recommendation from the counseling department of TCC. Texas Chiropractic College policy is designed to comply with the ADA and Section 504 as well as the guidelines outlined by the Association on Higher Education and Disability (AHEAD).

NB: THE INSTRUCTOR RESERVES THE RIGHT TO MAKE CHANGES TO THIS SYLLABUS DURING THE TRIMESTER. CHANGES, ADDITIONS OR ANNOUNCEMENTS MAY BE MADE IN CLASS, POSTED ON Edvance 360 WEBSITEAND/OR SENT VIA EMAIL.