El Paso Community College
Syllabus
Part II
Official Course Description

SUBJECT AREA	**Radiation Therapy Technology**
COURSE RUBRIC AND NUMBER	**RADT 2315**
COURSE TITLE	**Radiologic Physics II**
COURSE CREDIT HOURS	**3 3 : 1** **Credits Lec Lab**

I. Catalog Description

Provides a continuance of Radiologic Physics I. Discusses advanced concepts of radiation and nuclear physics. A grade of a "C"or better is required to take the next course. **Prerequisite: RADT 2317. (3:1). Lab fee.**

II. Course Objectives

A. Unit I. Structure of Matter and Properties of Radiation
1. Compare and contrast atomic structure and composition among the elements, including but not limited to particles (their location, energy level, and charge), atomic number, and mass number.
2. Compare isotope, isotone, and isomer.
3. Explain nuclear stability and types of radioactive decay.
4. Categorize the four fundamental forces of nature.
5. Describe electromagnetic (EM) radiation and the characteristics of the EM spectrum and the various radiations.
6. Describe the process of ionization and excitation.

B. Unit II. Nuclear Transformations
1. Define and compare radioactivity, decay constant, activity, and half-life.
2. Differentiate between artificially produced and naturally occurring therapeutic nuclides.
3. Examine the radioactive series and the decay schemes for commonly used radiation therapy nuclides.
4. Differentiate between commonly used radiation therapy nuclides.
5. Explain various forms of radioactive equilibrium.
6. Calculate rate of decay, change in activity, average life, and attenuation requirements for a given isotope.
7. Identify nuclear reactions by recognizing the projectile and radiation emitted.
8. Define fission and fusion.
9. Discuss the activation of nuclides in terms of yield, probability, activity growth, and saturation activity.
10. Describe methods of artificial production of radionuclides and their use in medical applications.
11. Discuss the purpose of the major components of a nuclear reactor.

C. Unit III. Review of Production of X-rays
   1. Describe components of the x-ray tube and x-ray circuit.
   2. Describe x-ray production for linear accelerators.
   3. Explain the factors that influence x-ray production and output.

D. Unit IV. Clinical Radiation Generators
   1. Describe the energy ranges and characteristics of the various radiation therapy modalities (Grenz-ray through megavoltage).
   2. Describe all major components of a linear accelerator.
   3. Compare the characteristics of other radiation therapy beams (betatron, cyclotron, microtron, and other accelerated particles).
   4. State the gamma energies and average gamma energy of Cobalt-60.
   5. Define specific activity and discuss the maximum and average specific activity of a typical Cobalt-60 source.
   6. Describe the beam and beam edge characteristics of a Cobalt-60 beam.
   7. Describe the basic components of a Cobalt-60 unit.
   8. Compare the characteristics of an isotope beam and an artificially produced beam.
   9. Discuss the historical development of external beam radiation therapy.

E. Unit V. Interaction of Ionizing Radiation
   1. Explain linear energy transfer (LET).
   2. Compare photon interactions with matter and classify radiation produced by direct and indirect ionization.
   3. Explain major influencing factors of photon beam attenuation.
   4. Describe the parameters of narrow beam geometry used in the measurement of attenuation.
   5. Plot heteroenergetic and monoenergetic beam attenuation data.
   6. Calculate half-value layer (HVL).
   7. Explain the purpose of homogeneity coefficient.
   8. Calculate attenuation requirements for beam modification devices.
   9. Discuss activation of clinical accessories and alternate shielding materials due to photodisentigration.
   10. Explain charged particle interactions with matter, describing dose deposition, energy loss, and shielding requirements.
   11. Define mass stopping power.
   12. Describe a Bragg curve.

F. Unit VI. Measurement of Ionizing Radiation
   1. Discuss roentgen as the unit of exposure.
   2. Discuss the purpose and importance of the National Institute of Standards and Technology (NIST).
   3. Discuss the purpose and importance of the Accredited Dosimetry Calibration Labs.
   4. Choose the appropriate type of radiation detector for a given clinical application.
   5. Explain how correction factors for chamber calibration, temperature, pressure, and other factors are used to correct a chamber reading.
   6. Participate in external beam calibration.
   7. Evaluate spot checks of external beam exposure to determine beam consistency and symmetry.

G. Unit VII. Quality of X-ray Beams
   1. Describe the quality of a gamma-ray beam in terms of HVL, gamma energy, or mean gamma energy/nuclide of origin.
   2. Describe beam filtration for the various external beam modalities, including but not limited to purpose, types of filters and their construction, inherent vs. added filtration, and effect on HVL.
   3. Calculate the approximate mean energy of a megavoltage beam.

H. Unit VIII. Measurement of Absorbed Dose
   1. Compare absorbed dose vs. exposure.
   2. Discuss the relationship between kinetic energy released in the medium (KERMA), exposure, and absorbed dose.
   3. Calculate air dose to absorbed dose conversions in tissue, including but not limited to energy considerations, applicable conversion factors, necessary instrumentation, and methods.

I. Unit IX. Dose Distribution and Scatter Analysis Overview
   1. Discuss the clinical importance of phantom material and size when applying the Bragg-Gray Cavity Theory.
   2. Critique how dose distribution measured in a phantom is used to predict dose distribution in a patient.
   3. Compare the characteristics and composition of various phantoms.
   4. Compare the source-skin distance (SSD) and isocentric methods of calibration.

III. THECB Learning Outcomes (WECM)

1. Describe the radioactive process and law of decay.
2. Explain advanced principles of nuclear physics.
3. Solve classical physics problems dealing with topics such as force, work, energy, frequency and wavelength

IV. Evaluation

A. Methods:
   1. Homework and quizzes
   2. Unit examinations
   3. Comprehensive final examination
   4. Labs/Participation

B. Grading Scale:
   93-100 = A
   85-92 = B
   75-84 = C
   74 and below = F

V. Disability Statement (American with/Disabilities Act [ADA])

EPCC offers a variety of services to persons with documented sensory, mental, physical, or temporary disabling conditions to promote success in classes. If you have a disability and believe you may need services, you are encouraged to contact the Center for Students with Disabilities to discuss your needs with a counselor. All discussions and documentation are kept confidential. Offices located: VV Rm C-112 (831-2426); TM Rm 1400 (831-5808); RG Rm B-201 (831-4198); NWC Rm M-54 (831-8815); and MDP Rm A-125 (831-7024).

VI. 6 Drop Rule

Students who began attending Texas public institutions of higher education for the first time during the Fall 2007 semester or later are subject to a 6-Drop limit for all undergraduate classes. Developmental, ESL, Dual Credit and Early College High School classes are exempt from this rule. All students should consult with their instructor before dropping a class. Academic assistance is available. Students are encouraged to see Counseling Services if dropping because exemptions may apply. Refer to the EPCC catalog and website for additional information.