Course title: *The Physics of Radiology*. Offered M/W 3-4:14; 250 Administration

Course Description: This is an intensive 3-unit course covering the physics principles of ionizing radiation, the resulting radiobiological effects of ionizing radiation, and both the diagnostic and therapeutic uses of radiology in medicine. This course would provide students with a comprehensive and detailed overview and understanding of the physics of radiology, suitable for preparing students for more advanced study as would be required for those interested in pursuing medical radiation professional career tracks, including medical physicists, medical radiation dosimetrists, nuclear medicine technologists, radiation oncology physicians and radiologists.

Pre and Co-requisites: Physics 8 and 9, or physics 18 and 19 are prerequisites. Physics 10 is recommended as a co-requisite.

Textbook: The Physics of Radiology, Johns and Cunninham 5th edition

Comments: Course description: The course covers basics physics concepts, the production and properties of x-rays, the interaction of ionizing radiation with matter, the interaction between photons and charged particles with matter, the fundamentals of nuclear physics and radioactivity, high energy x-ray machines and equipment, the dosimetry of radiation, radiobiology principles, treatment planning, and radiation protection.

Program Learning Outcomes

The following *Biological Sciences Program Learning Outcomes* have been adapted and applied to the material in this course so that students, by the end of this program, will demonstrate proficiency in the following areas:

1. **A detailed knowledge of the fundamental physical principles involved in the production of ionizing radiation and the direct medical applications that make use of these principles for both therapeutic and diagnostic use**
2. **A demonstrated expertise and competency in the use of mathematical tools necessary to evaluate these specific radiological principles involved in these medical applications.**
3. **Ability to communicate their scientific work and findings, and an enhanced ability to work collaboratively.**
4. **An ability to articulate and quantitatively describe the specific physics models as they pertain to the production of ionizing radiation, the interaction of x-rays and matter, and the radiobiological effects of ionizing radiation.**
5. **An ability to develop and critique hypotheses, to design experiments, models, and to propose and predict outcomes that illustrate a deeper understanding of these models.**
6. **The ability to read, evaluate, interpret, and apply numerical and specific scientific information applicable to the study of ionizing radiation and its use in medicine.**

Course topics – 18 weeks:

Week	Topic	Week	
1	Basic Concepts Review (quantities, units)	10	Treatment Planning Protocols - 2
2	The Production of Ionizing Radiation	11	Brachytherapy
3	Nuclear Fundamentals and Radioactivity	12	Nuclear Medicine - Therapeutics
4	Interaction of Ionizing Radiation and Matter	13	Nuclear Medicine - Diagnostics
5	Interaction of Charged Particles and Matter	14	Imaging – CT Scanning
6	High Energy X-ray Machines	15	Imaging – PET Scanning
7	Radiation Measurement and Dosimetry	16	Thanksgiving week

8	Radiobiological Effects of Ionizing Radiation	17	Imaging - MRI
9	Treatment Planning Protocols - 1	18	Final Exam