

NRE 3301 Radiation Physics (Required)

Catalog Description: NRE 3301 Radiation Physics (3-0-3)

Prerequisites: Math 1502 and Phys 2211

NRE 3301 studies characteristics of atomic and nuclear radiations, nuclear models, types of radioactive decay, kinematics of nuclear reactions, calculation of cross sections, and interaction of radiation (neutron, gamma, charged particle) with matter.

Textbook: J. Turner, *Atoms, Radiation and Radiation Protection*, Third Edition, Wiley, 978-3-527-40606-7

Reference: J. Kenneth Shultis and Richard E. Faw, *Fundamentals of Nuclear Science and Engineering*

Topics Covered:

- Special theory of relativity
- Wave particle duality
- Atomic structure and atomic radiation
- The nucleus and nuclear radiations
- Nuclear models and nuclear energetics
- Characteristics of radioactive decay
- Radiation cross sections
- Neutron interactions with matter, fission, criticality
- Interaction of heavy charged particles with matter
- Interaction of electrons with matter
- Interaction of photons with matter

Course Outcomes:

Outcome 1. To acquaint students with the basic atomic and nuclear physics concepts

- 1) The student will be able apply the basic theories of atomic physics including the special theory of relativity, wave particle duality, models of the atom, uncertainty and exclusion principles to radiation physics.
- 2) The student will be able to apply the basic concepts in nuclear physics including nuclear models, binding energy, mass defect, binding energy curve, nuclear reactions, Q values and energetics of nuclear reactions to radiation physics.

Outcome 2. To enable students to do quantitative assessment of radioactivity

- 1) The students will be able to solve problems in nuclear and radiological engineering using radioactive decay law, activities, half life, decay constant, types of radioactivity, decay chains, secular and transient equilibrium and radiodating.

Outcome 3. To acquaint students with the theories of the interaction of ionizing radiation with matter.

- 1) The students will be able to characterize neutron, photon electron and charged particle interaction with matter and calculate interaction cross sections, charged

particle range and stopping power and energy transfers with regard to radiation interactions with matter.

Correlation between Course Outcomes and Program Educational Outcomes:

NRE 3301 Radiation Physics	Outcome a			Outcome b	Outcome c	Outcome d	Outcome e	Outcome f	Outcome g	Outcome h	Outcome i	Outcome j	Outcome k
	i	ii	iii										
Course Outcomes													
Course Outcome 1.1		X											
Course Outcome 1.2		X											
Course Outcome 2.1		X											
Course Outcome 3.1		X											