



## ENGR 4502 - Radiation Protection & Health Physics Fall 2017

### Prerequisite(s)

ENGR 3501 - Fundamentals of Nuclear Engineering

### Required or Elective

Required if minoring in Nuclear Engineering

### Meeting Location, Days and Times

Q-315 T R 11:00 AM – 12:15 PM

### Instructor

**Dr. Eduardo B. Farfan**, Professor of Nuclear Engineering

**E-mail:** efarfan1@kennesaw.edu

**Office Phone:** 678-915-4971

**Office Location:** Q-146

**Office Hours:**

T R 1:45 PM – 2:30 PM (by appointment only)

W 10:30 AM – 2:00 PM (by appointment only)

### Textbook

Basic Health Physics: Problems and Solutions, 2nd Edition. Joseph John Bevelacqua.  
ISBN: 978-3-527-40823-8

**Make sure to acquire the book by the end of the first week of classes.**

### Course Description

This course covers the fundamentals of individual and population health protection against the harmful effects of radiation. Topics included are: different sources of radiation, interaction of radiation with matter, radiation exposure principles and measurement, relationship between radiation exposure and biological damage, radiation protection and safety standards and guidelines, radiation protection instrumentation, internal and external radiation protection, pathways of radiation movement in the environment, and radiation shielding.

## Learning Objectives

Upon completion of the course, the students should be able to:

1. Describe the nature of radioactivity and transformation mechanisms.
2. Discuss the mechanism of radiation interaction with matter.
3. Illustrate methods of radiation measurement.
4. Exemplify the physical and biological effects of radiation.
5. Summarize the radiation protection standards, guidelines and recommendations.
6. Illustrate the types of instrumentation used in radiation measurement and protection.
7. Identify the elements of radiation exposure, protection and shielding.
8. Differentiate between various radiation sources, exposure, pathways and their related risks.
9. Calculate radiation exposure and perform associated risk analysis.
10. Explain the methods and approaches for implementation of a radiation protection program.

## Topics Covered

1. Radiation sources
2. Interaction of radiation with matter
3. Principles and measurement of radiation exposure
4. Relationship between radiation exposure and biological damage
5. Radiation protection, safety standards, and guidelines
6. Radiation protection instrumentation
7. Internal and external radiation protection
8. Pathways of radiation movement in the environment
9. Radiation shielding

## Grading

Attendance	5%
Homework – Solving assigned problems on blackboard	10%
Project	25%
Midterm 1	20%
Midterm 2	20%
Final	20%
<b>Total</b>	<b>100%</b>

**Grade Conversion:** A: (90-100), B: (80-89), C: (70-79), D: (60-69), F: (0-59)

**Homework:** The students must complete the problems assigned by the instructor and solve them on the blackboard on the due date.

**Exams and Project:** All students are expected to be present at the time exams and project presentations are given. Students not present at the time when an exam or presentation is given will receive a “0” for that exam or presentation. No make-up exams will be given, unless the student makes arrangements with the instructor, prior to the

exam due date, to receive an excused absence. The students will be informed when an exam will take place (e.g., at least a week before the exam).

## Course Outline

Unit	Lecture	Homework/Exams/Project *
1	Review of Mathematics	
2	Atomic and Nuclear Physics Overview	
3	Radioactivity	
4	Interactions of Radiation with Matter	
5	Dosimetric Quantities	HW 1
6	Natural and Man-made Sources	
7	Standards and Regulations	
8	Biological Effects of Radiation	Exam 1
9	Instrumentation	
10	External Dosimetry	
11	Internal Dosimetry	HW 2
12	ALARA and Shielding	
13	Counting Statistics	
14	Monitoring and Interpretations	
15	Operational Health Physics	Exam 2
16	Transportation and Waste	
17	Nuclear Emergencies	HW 3
18	Medical Health Physics	
19	University Health Physics	
20	Fuel Cycle Health Physics	
21	Power Reactor Health Physics	
22	Environmental Health Physics	
23	Accelerator Health Physics	HW 4 - Project
24	Non-Ionization Health Physics (optional)	Exam 3

\*Students will be informed about an upcoming exam at least a week before the exam due date. Students will be given at least a week to complete the homework assignments.

## Use of Electronic Equipment in Class

- Calculators will be used periodically in class.
- Use of phones, tables, and pagers in not permitted in class.
- Use of computers will be allowed only with the instructor's permission.

## No Sleeping and Disruptive Behavior in Class

- Students sleeping in class will be asked to leave the classroom.

- Students misbehaving in class will be asked to leave the classroom. If they refuse to do so, campus police will escort them out.

## Tips for Effective Learning

- **Work closely with your instructor.** If you have any questions, please contact me immediately. The best way to contact me is via email or phone call, and you will be guaranteed to have a reply within 24 hours.
- **Begin your work early.** If you can start a task early, don't start late. Assuming you spend the same amount of time completing the task, starting later will be much more stressful than starting early. Never wait until the last minute to begin an assignment! You'll have no turnaround time if you need help or something happens.

## Emergency Plan

If the University is closed for more than a day or two by some kind of emergency (major weather event, flu epidemic, etc.), please check your KSU email for information on assignments.

## University Policies

### Academic Honesty

“A faculty member reserves the right to remove any student from his or her course if the student's behavior is of a disruptive nature or if there is evidence of academic dishonesty.” (*KSU Catalog*)

### Plagiarism Policy

KSU defines Plagiarism as the practice of taking someone else's work or ideas and passing them off as one's own. When unaware or uncertain on how to properly cite a particular source, please do not neglect to add the citation—KSU considers not doing so as plagiarism.

KSU considers committing plagiarism as an act of academic dishonesty, and takes all occurrences very seriously. Any instances where academic dishonesty is suspected will result in an automatic grade of a zero for all students involved. Further disciplinary action may be taken such as suspension or expulsion from the University.

If you have questions on how to cite your work, please contact me immediately! For more information, please refer to the “Plagiarism Policy” under the *Policies* section of this syllabus.

### Honor Code

As a member of the Southern Polytechnic State University community of scholars, I understand that my actions are not only a reflection on myself, but also a reflection on the University and the larger body of scholars of which it is a part. Acting unethically, no matter how minor the offense, will be detrimental to my academic progress and self-image. It will also adversely affect all students, faculty, staff, the reputation of this

University, and the value of the degrees it awards. Whether on campus or online, I understand that it is not only my personal responsibility, but also a duty to the entire KSU community that I act in a manner consistent with the highest level of academic integrity. Therefore, I promise that as a member of the Southern Polytechnic State University community, I will not participate in any form of academic misconduct. I also understand that it is my responsibility to hold others to these same standards by addressing actions that deviate from the University-wide commitment to working, living, and learning in an environment conducive to a quality education. Thus, I affirm and adopt this honor code of Southern Polytechnic State University.

### **ADA Compliance Statement**

“If you have a documented disability as described by the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) that may require you to need assistance attaining accessibility to instructional content to meet course requirements, we recommend that you contact the ATTIC at 678.915.7361 as soon as possible. It is then your responsibility to contact and meet with your instructor. The ATTIC can assist you and the instructor in formulating a reasonable accommodation plan and provide support in developing appropriate accommodations for your disability. Course requirements will not be waived but accommodations will be made, when appropriate, to assist you to meet the requirements”.

### **FERPA**

The Family Education Rights and Privacy Act is a federal law designed to protect the privacy of educational records by limiting access to these records, and precludes Southern Polytechnic State University from providing information regarding the student to anyone without written authorization. Examples of records not released are grades; grade point average; the specific number of hours/credits enrolled, passed, or failed; Social Security Number; student ID number; name of parents or next of kin; and/or residency status.

### **Ethics/Sexual Harassment Policy**

Sexual harassment in any situation is reprehensible. It subverts the mission of the University, and threatens the careers of students, faculty, and staff. It is viewed as a violation of Title VII of the 1964 Civil Rights Act as amended by the 1991 Civil Rights Act. Sexual harassment will not be tolerated at Southern Polytechnic.

Southern Polytechnic State University is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, disability, age, sexual orientation, or veteran status. In adhering to this policy, the University abides by the requirements of Title IX of the Education Amendments of 1972; by Title VII of the Civil Rights Act of 1964, as amended by the Civil Rights Acts of 1991; by Sections 504 and 504 of Rehabilitation Act of 1973; by Executive Order 11246, as amended by 38 U.S.C. 2012; the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

This policy on sexual harassment applies to the entire University and to the conduct of students, faculty, and staff alike.