# COURSE PROFILE

**Degree Program:** Nuclear Engineering and Radiological Sciences  
**Date:** May 2017

**Prepared by:** Sara Pozzi

## COURSE #:

NERS 554/ 4 CREDITS/ SELECTIVE

## COURSE TITLE:

Radiation Shielding Design

## TERMS OFFERED:

Winter

## TEXTBOOKS/REQUIRED MATERIAL:

MCNP 5, MCNP X, MCNP-PoliMi

## PREREQUISITES:

ERS 441 or NERS 484 (A)

## INSTRUCTOR(S):

Pozzi

## COGNIZANT FACULTY:

Pozzi, Clarke

## CoE BULLETIN DESCRIPTION:

Neutron and photon transport using Monte Carlo and analytical methods. Student groups participate in a semester-long project to design radiation shields, collimators, sources, and detectors for a variety of applications, including space, medical, and security. Project results include a feasibility study, dosimetric assessments, detector response functions and materials selection; final designs are also subject to realistic constraints and engineering standards.

## COURSE TOPICS:

Design process, characterization of radiation fields, radiation dose to biological systems and electronics, radiation shielding design, regulatory constraints & ALARA, radiation interactions of interest in energy degradation, secondary radiation generation, detector response functions, Monte Carlo, tallies, variance reduction techniques, manufacturability, activation and disposal of materials, facility impacts & constraints, competing needs.

## COURSE STRUCTURE/SCHEDULE

- Lecture: 2 per week @ 80 minutes
- Discussion: 1 per week @ 1 hour

## COURSE OBJECTIVES

1. To have students approach open ended problems in radiation shielding and radiological sciences
2. To have students work in groups of 3-6 members and develop team management skills
3. To reinforce students’ understanding of radiation fields and radiation interactions
4. To introduce students to the ideas of Monte Carlo radiation transport and to production codes
5. To have students analyze a system subject to realistic constraints, engineering standards, and competing requirements
6. To have students design or optimize a radiation shield or other radiological engineered system subject to realistic constraints
7. To have students question the fundamental purpose of an engineered system, and its long-term impact
8. To have students practice and improve their written and oral communications skills

## COURSE OUTCOMES

1. Students will be able to use a production Monte Carlo code to model fixed source radiation systems and usefully interpret the results [1,2,3,4,5,6,9,10]
2. Students will be able to work in groups and delegate work among the group members. [6,7]
3. Students will be able to explore an open-ended problem in radiation shielding design or analysis [2,3,4,5,9,10,11]
4. Students will be able to design a radiation shield or other radiological engineered system subject to realistic constraints [3,4,5,9,10,11]
5. Students will be able to describe the social benefit of their work, and to consider its long term impact on society and the environment [8,9,10,11]
6. Students will be able to professionally communicate in both written and oral form [6,7,11]

## ASSESSMENT TOOLS

1. Individual and group exercises with written and oral reports
2. Oral progress reports presented to class
3. Written final report
4. Oral final report presented to class and a public forum
5. Workload evaluation providing self-assessment of shared load in group
6. Standard course evaluation as well as a specific course-oriented evaluation testing the success of realizing the course objectives and outcomes.

Revision History: September, 1998; May, 2005; June, 2010; May 2017