Degree Program: Nuclear Engineering and Radiological Sciences
Prepared by: Ronald Fleming

COURSE #: NERS 211
COURSE TITLE: Introduction to Nuclear Engineering and Radiological Science
TERMS OFFERED: Fall, Winter

For each prerequisite below, “E” denotes Enforced and “A” denotes Advised.

TEXTBOOKS/REQUIRED MATERIAL:
Lockheed Martin, *Nuclides and Isotopes*, 16th Edition

PREREQUISITES: Preceded or accompanied by Math 216 (A)

INSTRUCTOR(S): Fleming
COURSE STRUCTURE/SCHEDULE
Lecture: 2 per week @ 110 minutes; Discussion: 1 per week @ 1 hours

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CoE BULLETIN DESCRIPTION:
This course will discuss the history of nuclear energy, the fundamentals of fission and fusion nuclear power, and a variety of radiological health applications. Current topics in the media such as radon, radioactive waste, and nuclear proliferation may also be covered.

COURSE TOPICS:
- Energy and Radioactivity (5 h)
- Radiation and Biological Effects (6 h)
- Introduction to Fission Reactors (14 h)
- Introduction to Fusion Reactors (4 h)
- Alternate Uses of Nuclear Radiation (8 h)
- Applications of Nuclear Technology to Industry And Agriculture (2 h)
- History of Nuclear Engineering (2 h)
- Environmental Effect of Nuclear Radiation (9 h)
- Ethical Issues Surrounding Nuclear Technology (2 h)

COURSE OBJECTIVES
1. To teach students how fundamental concepts apply to nuclear engineering design in a broad variety of nuclear applications [1, 2, 3]
2. To introduce students to the analytical methods and computational tools for nuclear engineering [1, 2, 3]
3. To prepare students to make decisions regarding ethical, economic, and environmental aspects of nuclear energy [8, 9]
4. To provide experience for students to work in teams addressing public information and ethics problems relating to nuclear engineering [6, 7, 8, 9, 10, 11]
5. To provide experience for student to practice oral and written communication skills [7]
6. To expose students to career opportunities in nuclear engineering and radiological sciences [12]
COURSE OUTCOMES

For each course outcome, links to the Program Outcomes are identified.

1. Demonstrate knowledge of the fundamentals of energy and radioactivity [1, 2]
2. Formulate simple problems involving radioactive decay and radiation interactions [1, 2]
3. Be familiar with basic nuclear terminology and the breadth of current and potential nuclear applications [1, 6]
4. Understand the fundamentals of sustained neutron chain reactions and fission reactor design [1, 2, 6]
5. Understand the fundamentals of fusion and fusion/plasma applications [1, 2, 6]
6. Understand the fundamentals of one or more non-power-related nuclear applications [1, 2, 6]
7. Understand in general terms the risks and environmental concerns associated with ionizing radiation and limitations in knowledge of these [3, 4, 5]
8. Be generally familiar with the history of nuclear engineering [3, 4, 5]
9. Complete written and/or oral reports on one or more group activities relating to nuclear issues or nuclear design [1, 2, 3, 4, 5]

ASSESSMENT TOOLS

For each assessment tool, links to the course outcomes are identified.

6. A combination of during-term test(s) and/or final examination will be used to measure outcomes [1-8] for individual students under a time constraint
7. Problem sets measure outcomes [1-6] under less time pressure and allow student collaborations.
8. Graded group activities relating to public communications, dealing with uncertainty, environmental impacts and issues and professional activities will measure outcomes [7-9]
4. Course evaluation by each student at the end of the course assesses all outcomes [1-9]