1. ER301 Fundamentals of Nuclear Engineering

2. Credits Hours (3) / Contact Hours (3)

3. Course Director: Prof Mark Murray

4. Textbook: *Fundamentals of Nuclear Science and Engineering*, 3rd edition, Shultis and Faw, 2008 – ISBN 978-1-4987-6929-7

   Other supplemental materials:

   (1) NAVSEA Applied Engineering Principles Manual, Chapter 3.
   (2) Nuclear Engineering Handbook, Edited by K.D. Kok, CRC Press.
   (3) Introduction to Nuclear Engineering, Third Edition, Lamarsh and Baratta.

5. Specific course information

   a. An introductory course in the basics of nuclear engineering and radiological sciences. Subject areas include the basics in radiation physics, nuclear core physics, nuclear plant design, the fuel cycle and radiological health physics.
   b. Prerequisites: SP211; Co-requisites: SP212
   c. Required course for the Nuclear Engineering Program

6. Educational objectives for the course

   a. Demonstrate an understanding of the basic types of radiation including the sources of radiation, radioactive decay, interaction with matter and detection.
   b. Demonstrate the ability to solve radiation problems involving radioactive decay and shielding.
   c. Demonstrate an understanding of mechanism of power production in a nuclear reactor including fission, neutron life cycle, criticality, moderation, temperature coefficient of reactivity and control.
   d. Demonstrate the ability to solve reactor physics problems involving mass defect, fission reaction rates and the six factor formula.
   e. Demonstrate an understanding of the basic design of nuclear power plants including PWR's, BWR's and other reactors, and the thermal, hydraulic, safety and containment issues associated with each.
   f. Demonstrate an understanding of the basics of radiological health physics including biological effects of radiation, dose and exposure, and the concept of dose minimization.
   g. Demonstrate an understanding of the nuclear fuel cycle including mining, enrichment, reprocessing and spent fuel disposal.

7. Specific program outcomes address by this course

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Reinforced	X			X			X
Mastered							

8. Brief list of topics to be covered:

   a. Basic Nuclear/Radiological Applications
   b. Types of Radiation and Sources
   c. Radioactivity and Decay
   d. Radiation Interaction with Matter
   e. Radiation Detection
   f. Nuclear Fission and Mass Defect
   g. Micro/Macro Cross Sections
   h. Core Physical Design (Fuel/Moderator/Poisons)
   i. Neutron Life Cycle
   j. Reactor Physics
   k. PWR and BWR Plant Design
   l. Reactor Safety and Containment
   m. Biological Effects of Radiation
   n. Exposure and Dose
   o. Minimization of Exposure
   p. Fuel Cycle Front End (Mining/Enrichment/Fabrication)
   q. Fuel Cycle Back End (Reprocessing/Spent Fuel Disposal)