1. ER468 Nuclear Plant Engineering

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

3. Course Director: CDR Angel Rodriguez, USN PMP Ph.D.

4. Textbook: *Nuclear Plant Engineering*, CAPT Stuart Blair, United States Naval Academy, 2022 (pdf availability only)

Other supplemental Materials:

- *Nuclear Systems: Thermal and Hydraulic Fundamentals*, Neil Todreas and Mujid Kazimi, 2012
- *Nuclear Reactor Thermal Hydraulics: An Introduction to Nuclear Heat Transfer and Fluid Flow*, Robert Masterson, 2020

5. Specific course information:
   a. Fundamentals of the thermodynamics, fluid mechanics, and heat transfer associated with the design, operation, and safety of nuclear power plants are analyzed. Thermal hydraulic fundamentals are applied to the reactor core, primary, and secondary systems. Effects of reactor transients are also analyzed.
   b. Prerequisites: ER301
   c. Required course for the Nuclear Engineering program.

6. Specific goals for the course (course outcomes)
   a. Students will demonstrate an understanding of the basic thermal design of modern nuclear power plants.
   b. Students will demonstrate an understanding of the first and second law of thermodynamics as applied to Rankine energy conversion cycles.
   c. Students will demonstrate an understanding of the thermodynamic analysis of energy conversion systems based on the Brayton cycle.
   d. Students will demonstrate an ability to analyze energy conversion cycles based on combinations of Rankine and Brayton cycles with a variety of working fluids.
   e. Students will demonstrate an understanding of hydraulic analysis of fluid systems associated with nuclear power plants including primary and secondary systems in both forced and natural circulation.
   f. Students will demonstrate an understanding of conductive heat transfer for nuclear fuel materials in all applicable forms.
   g. Students will demonstrate an ability to analyze convective heat transfer processes applicable to a nuclear power reactor core, energy conversion systems, and rejection to the environment
   h. Students will demonstrate an ability to analyze system response to transients to allow design analysis of PWR pressurizer and containment sizing.

7. Specific program outcomes address by this course:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Introduced							
Reinforced	x	x		x	x	x	
Mastered							x

8. Brief list of topics to be covered:

a. Basic Nuclear Thermal Design Review
b. Thermodynamics – Rankine Cycle
c. Thermodynamics – Brayton Cycle
d. Thermodynamics – Combined Cycle
e. Hydraulics applied to nuclear power
f. Heat transfer – non-linear conduction
g. Heat transfer – convection applied to nuclear power
h. Transient analysis and safety system design