United States Naval Academy
Mechanical Engineering Department
ER468 Nuclear Plant Engineering

Catalog Description: ER468 Nuclear Plant Engineering **Credit:** 3 (3-0-3)
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.

Prerequisites: ER371 (Nuclear Plant Design)
Corequisites: None

Textbooks: Todreas, Neil and Kazimi, Mujid, *Nuclear Systems: Thermal and Hydraulic Fundamentals*, vol 1, 2nd edition, CRC press, 2012.

Supplemental Material:
Moran, Michael J. et al., *Fundamentals of Engineering Thermodynamics*, 7th edition, Wiley, 2011

Course Director: CDR Stu Blair

Course Content:

No.	Topic or Subtopic	hrs.
1.	Basic Nuclear Thermal Design Review	2
2.	Thermodynamics – Rankine Cycle	10
3	Thermodynamics – Brayton Cycle	6
3	Thermodynamics – Combined Cycles	6
4.	Hydraulics applied to nuclear power	10
5.	Heat transfer – non-linear conduction	4
6.	Heat transfer – convection applied to nuclear power	6
7.	Transient analysis and safety system design	5

Assessment Methods:

		YES	NO
A	Quizzes	X	
B	Homework	X	
C	Exams	X	
D	Laboratory Reports		X
E	Oral Presentations		X
F	Design Reports/Notebooks		X
G	Prototypes/Demonstrations		X
H	Projects		X
I	Other		X

Course Outcomes[1]:

1. Students will demonstrate an understanding of the basic thermal design of modern nuclear power plants. (A,B,C)
2. Students will demonstrate an understanding of the first and second law of thermodynamics as applied to Rankine energy conversion cycles. (A,B,C)
3. Students will demonstrate an understanding of the thermodynamic analysis of energy conversion systems based on the Brayton cycle. (A,B,C)
4. Students will demonstrate an ability to analyze energy conversion cycles based on combinations of Rankine and Brayton cycles with a variety of working fluids. (A,B,C)
5. 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. (A,B,C)
6. Students will demonstrate an understanding of conductive heat transfer for nuclear fuel materials in all applicable forms. (A,B,C)
7. 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 (A,B,C)
8. Students will demonstrate an ability to analyze system response to transients to allow design analysis of PWR pressurizer and containment sizing. (A,B,C)

[1] Letters in parenthesis refer to the assessment methods listed in previous section.

	Course Outcomes							
Program Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a)		✓	✓	✓	✓	✓	✓	✓
(b)								
(c)				✓	✓			✓
(d)								
(e)		✓	✓	✓	✓	✓	✓	✓
(f)								✓
(g)								
(h)								
(i)								
(j)	✓							✓
(k)	✓	✓	✓	✓	✓	✓	✓	✓

Date of Latest Revision: 21 APR 2017