MECHANICAL ENGINEERING PROGRAM

ABET COURSE SYLLABUS

ME 439 Nuclear Power Plant Operations. (4 Units) Elective

Course Description: (2019-20 Catalog)	Overview of mass, momentum and energy conversion related to nuclear power plants; includes coupled neutronic/thermal models to study plant operation semi-quantitatively achieving an integrated plant understanding. Content includes: Neutron power kinetics, Coupled neutronic/thermal hydraulic modeling, Quantitative transient modeling, demonstration transients. Field trip may be required. 4 lectures.
Prerequisite Courses:	ME 437 or ME 438.
Prerequisites by Topic:	Nuclear Energy Power Generation or Nuclear Power Plant Design.
Textbook: (and/or other required material)	No required textbook
References:	R. A. Knief, *"Nuclear Engineering, Theory and Technology of Commercial Nuclear Power,"* 2nd Edition, American Nuclear Society Inc, 2014. R. L. Murray and K. E. Holbert, "*Nuclear Energy, In Introduction to the Concepts, Systems, and Applications of Nuclear Processes*," 7th Edition, Elsevier, 2015. DOE Fundamentals Handbook, *Nuclear Physics and Reactor Theory*, Volume 1 and 2, DOE-HDBK-1019/1-93, January 1993
Course Coordinator/Instructor:	Jacques Belanger, Assistant Professor of ME
Course Learning Outcomes:	The overall course objective is to provide a fundamental understanding of the mass, momentum and energy conversion equations related to nuclear power plants. It includes coupled neutronic/thermal models to study plant operation semi-quantitatively achieving an integrated plant understanding. This fundamental familiarity will serve as basis for further study, research, and employment for the practicing engineer. For the nuclear physics portion, the objectives can be best stated in terms of abilities to analyze neutron power kinetics and coupled neutronic/thermal hydraulic modeling. For the power plant, the objectives can be best stated in terms of abilities to design quantitative transient modeling and perform transient demonstrations of such a system. By subdiscipline, the course goals are:

1. Interpret the behavior of a nuclear power plant under different operational conditions.
2. Create coupled neutronic/thermal hydraulic models.
3. Construct models for semi-quantitative analysis of plant operation.
4. Analyze plant operations through virtual labs.
5. Evaluate the results of the plant modeling exercises for accuracy based on fundamental engineering principles.

Relationship of Course to Mechanical Engineering Student Outcomes:

SO 1: Mastered (M)
SO 2:
SO 3: Mastered (M)
SO 4:
SO 5: Mastered (M)
SO 6:
SO 7: Mastered (M)

Topics Covered:

1. Nuclear reactor physics
2. Reactor transients
3. Reactor operations
4. Reactor modeling
5. Control loops
6. Reactor response
7. Critical operations
8. Startup from cold/BWR-PWR differences
9. Human performance fundamentals
10. The individual/worker/end user

Laboratory Projects: No lab but a field trip to Diablo Canyon Power Plant

Class/Lab Schedule: Four 50-minute lectures per week.

Contribution of Course to Meeting the Professional Component:

(a) College-level mathematics and basic sciences:	0 credits
(b) Engineering Topics:	4 credits
Design:	0 credits
(c) General Education:	0 credits
(d) Other:	0 credits

Prepared by:
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Date:
11/22/19