MECHANICAL ENGINEERING PROGRAM

ABET COURSE SYLLABUS

ME 437 Nuclear Energy Power Generation. (4 Units) Elective

Course Description: (2019-20 Catalog)	Operation of a nuclear electric generation station; includes reactor water chemistry, material science, electric science, mechanical science, civil engineering for the nuclear power plant engineers and digital process control systems. Field trip may be required. 4 lectures.
Prerequisite Courses:	ME 302 and PHY 133.
Prerequisites by Topic:	Thermodynamics I and General Physics III.
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, An 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 physics of nuclear energy and explore different applications in the field of power generation. This fundamental familiarity will serve as basis for further study, research, and employment for the practicing engineer. For each subdiscipline, the objectives can be best stated in terms of abilities to analyze certain specific types of applications. The students will be able to formulate models based on a theoretical appreciation of the basic concepts. By subdiscipline, the course goals are:

1. Describe and explain the basics of nuclear reactor terminology, definitions, and concepts associated with reactor physics and theory and technology of nuclear power plant.
2. Apply principles of nuclear physics for use in nuclear power systems.
3. Develop an understanding of nuclear reactor physics for control of nuclear reactors.

4. Describe and explain the past, current, and future generations of nuclear power systems for both nuclear fission and nuclear fusion.
5. Explain engineering design principles and considerations including safety and environmental impact used in nuclear power plant design.
6. Describe the function and mode of operation of the different sensing and indicating devices used in nuclear power plants.
7. Using a nuclear reactor model software, evaluate the different safety features of the plant and determine the accuracy of the simulations based on fundamental engineering principles.
8. Explain the nuclear energy fuel cycle.

Relationship of Course to Mechanical Engineering Student Outcomes:

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

Topics Covered:

1. Modern nuclear power plant
2. Nuclear energy electricity generation
3. Nuclear physics
4. Nuclear reactor physics
5. Past and current generations of nuclear reactors
6. Nuclear reactor requirements and types
7. Generation IV nuclear reactors
8. Fusion and other nuclear energy applications
9. Fuel cycle

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: Jacques Belanger

Date: 11/22/19