Mechanical Engineering Dept. Department

Syllabus
ME 490: Specia topics in Mechanical engineering (3-0-3)

Course Catalog Description:

This course will provide the fundamentals of nuclear thermal-hydraulics for reactor design and safety assessment. It will cover a detailed understanding of thermal-hydraulic topics in different reactor designs. In addition, dedicated hands-on exercises will be performed to analyze real-life design and safety problems in light water reactors (which are currently in operation).

Course Pre-requisites:

- ME 448: Engineering of Nuclear Reactors

Course Objectives:

1. gain detailed knowledge of different reactor types along with their main design and operational characteristics.
2. gain detailed knowledge nuclear thermal hydraulics.
3. learn the fundamentals of core thermal hydraulic design.
4. learn the required computational methods to perform nuclear thermal hydraulic analyses of different reactor designs.
5. perform thermal hydraulic analyses of a design-based scenario.
6. perform thermal hydraulic analyses an accident-based scenario.

Course Learning Outcomes:

CLO1. gain detailed knowledge of different reactor types along with their main design and operational characteristics.

CLO2. gain detailed knowledge nuclear thermal hydraulics.

CLO3. perform thermal hydraulic analyses of a design-based scenario.

CLO4. perform thermal hydraulic analyses an accident-based scenario.

CLO5. learn the fundamentals of core thermal hydraulic design.

CLO6. learn the required computational methods to perform nuclear thermal hydraulic analyses of different reactor designs.

Learning Resources:

- N. E. Todreas, M. S. Kazimi, Nuclear Systems, Vol. 1, Taylor and Francis, 2012
- Research papers on related topics

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Term project	14	30.0%
Final exam	15	15.0%
Midterm	8	15.0%
Assignments	bi-weekly	20.0%
Quizzes	bi-weekly	20.0%

Lecture Weekly Schedule:

Week#	Topics
1	Nuclear reactor designs (PWR, BWR, LMFR, SMR, HTGR, ...)
2	Introduction to nuclear thermal hydraulics
3	Fundamentals of nuclear thermal hydraulics for reactor design and safety
4	Computational methods to perform nuclear thermal hydraulics analyses
5	Computational methods to perform nuclear thermal hydraulics analyses (Continue)
6	Thermal hydraulic analyses of a nuclear reactor design-based scenario
7	Thermal hydraulic analyses of a nuclear reactor design-based scenario (Continue)
8	Thermal hydraulic analyses of a nuclear reactor design-based scenario (Continue)
9	Thermal hydraulic analyses of a nuclear reactor design-based scenario (Continue)
10	Thermal hydraulic analyses of a nuclear reactor accident-based scenario
11	Thermal hydraulic analyses of a nuclear reactor accident-based scenario (Continue)
12	Thermal hydraulic analyses of a nuclear reactor accident-based scenario (Continue)
13	Thermal hydraulic analyses of a nuclear reactor accident-based scenario (Continue)
14	Thermal hydraulic analyses of a nuclear reactor severe accident-based scenario
15	Thermal hydraulic analyses of a nuclear reactor severe accident-based scenario (Continue)