ENME 489T
Nuclear Reactor Design

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Office Hours:	MW 12:30pm – 1:45pm
Classroom:	ITV 1100
Schedule:	MW 11:00 am – 12:15 pm
Text:	None

Course Description: ENME 489T presents the principles of nuclear reactor engineering as applied to reactor power plants. This includes nuclear reactor system design (reactor types and functional requirements of reactor systems), nuclear reactor materials (fuels, moderators, coolants, cladding and structural materials), nuclear reactor thermal-hydraulics, nuclear reactor shielding, nuclear reactor mechanical design (pressure vessels, piping, fuel), nuclear reactor safety analysis (types of accidents that must be considered during nuclear reactor design) and nuclear reactor accident consequence analysis (estimation of dose rates following a nuclear reactor accident).

Course Objectives: The major objective of ENME 489T is to have the student understand the fundamental concepts of nuclear reactor design in addition to the fundamental nuclear reactor physics concepts learned in ENME 430. A student who successfully completes ENME 489T is able to demonstrate the ability to:

1. Understand the basic functional requirements of fluid systems used in nuclear reactors, including primary coolant systems, auxiliary systems and emergency systems.

2. Understand the basic requirements for materials used in nuclear reactors, including fuel materials, coolant materials, moderator materials and structural materials.

3. Perform basic thermal-hydraulic calculations associated with the reactor core.

4. Perform basic nuclear reactor shielding calculations.

5. Perform basic structural calculations for pressure vessels and piping used in nuclear reactors.

6. Perform basic radiation dose calculations for radioactive materials that are released from a nuclear reactor following an accident.

.Grading Policy

Hour Exams (2):	100 each
Final Exam:	200
Homework:	100
TOTAL:	500

The student's final grade will be determined based on all course work (total of 500 possible points). The final grade is determined only after all course work is completed (i.e. after the final exam).

Examinations

There will be two one-hour exams and a final. Each hour exam will concentrate on the subject matter covered since the previous exam. However, keep in mind that engineering material builds on itself as a course progresses – students are expected to have mastery of all previous material. The final exam will be cumulative and cover all course material.

Homework

In order for the student to better understand the material presented in class, homework will be assigned. Problem sets will be collected at the beginning of the class on the due date. The problem sets will be worth 10 point each. Solutions to all problems will be posted on Blackboard. Students can work together, however copying homework is a violation of the Student Code of Academic Integrity – any occurrences will be referred to and dealt with by the Student Honor Board. Also, to be fair to all students, late homework will not be accepted under any circumstances.

Topic Outline

1) Elements of Reactor Design
   a) Reactor Concepts
   b) Reactor System Functional Requirements

2) Reactor Materials
   a) Fuel Materials
   b) Cladding Materials
   c) Moderator Materials
   d) Coolant Materials

e) Control Materials

3) Nuclear Reactor Shielding
   a) Radiation From Nuclear Reactors
   b) Interaction Of Radiation With Matter
   c) Shielding Calculations
   d) Shielding Design

4) Thermal And Fluid System Design
   a) Heat Generation During Operation
   b) Heat Generation After Shutdown
   c) Hot Channel Factors

5) Mechanical Design
   a) Elements Of Stress Analysis
   b) Thermal Stresses
   c) Creep
   d) Reactor Vessel Design
   e) Piping Design
   f) Fuel Element Design

6) Radioactive Releases
   a) Quantity Of Radioactive Materials In Reactor
   b) Containment Of Radioactivity
   c) Release Of Radioactivity
   d) Dose Rates After Release Of Radioactivity