

NE 511: Multi-Physics of Nuclear Reactors
Spring 2026

Course Description

Graduate level course focused on nuclear reactor multi-physics methods and techniques for multi-dimensional reactor analysis.

3 credit hours

Instructor

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Teaching Assistant

TBD

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Class location

331 111 Lampe Drive

Meeting time

Tu Th 11:45 AM – 1:00 PM

Prerequisites

NE 301: Fundamentals of Nuclear Engineering or equivalent.

Course Objectives

The objectives are to provide students with comprehensive knowledge in multi-physics methods and techniques; and to prepare them for modeling of steady state operation, cycle depletion, and transient scenarios for design and safety evaluations of current and next generations advanced nuclear reactors.

Student Learning Outcomes

By the end of this course, the student should be able to understand and apply the concepts and principles of:

- Multi-Physics Interactions in Nuclear Reactor Cores.
- Time-Dependent Phenomena in a Nuclear Reactor Cores.
- Prompt and Delayed Neutron Phenomena.
- Feedback Mechanisms.
- Space-Time Multi-Physics Methods for Reactor Core Analysis.
- Verification and Validation of Multi-Physics Simulations of Nuclear Reactors.
- Uncertainty Quantification in Multi-Physics Modeling of Nuclear Reactors.

Course Requirements and Evaluation Methods

- Homework & Quizzes: Typically, three homework assignments and seven quizzes are made over the course of the semester. 30% of the average. Homework assignments to be submitted via Moodle. Quizzes will be conducted during class period.

- Exams: Two in-class exams. 20% each.
- Project: One semester project involving modeling of multi-physics time phenomena in nuclear reactors. 30% of there are overall grade.
- Grading Scale: A+ (>100); A (92÷100); A- (90÷91); B+ (88÷89); B (82÷87); B- (80÷81); C+ (78÷79)
C (72÷77); C- (70÷71); D+ (68÷69); D (62÷67); D- (60÷61); F (<60)
- Late Assignments: Unless stated otherwise, assignments are due at the beginning of class on the designated due date. Assignments turned in within 24 hours of this time are considered LATE and will be assessed 25% penalty. Assignments turned in after 24 hours will be marked and returned to the student, but no credit will be assigned. To allow for unforeseen circumstances, students are granted a onetime exemption if an assignment is turned in by 5:00 PM on the designated due date. Exceptions to this policy may be granted for documented medical or family emergencies.

Attendance and Absence policy

- Face-to-face attendance is highly recommended.
- Active class participation is strongly encouraged. University policy on definition of excused absences: <http://policies.ncsu.edu/regulation/reg-02-20-03>

Required Textbook

No required textbook. Class notes and reading material will be provided free of charge.

Additional (optional) References

- K. Ott and R. Neuhold, Introductory Nuclear Reactor Dynamics, American Nuclear Society, 1985 (ISBN: 0-894-48029-4) or any new edition of this book
- W. M. Stacey, Nuclear Reactor Physics, John Wiley & Sons, 2001 (ISBN: 0-471-39127-1) or any new edition of this book

Computer and Internet Requirements

Please review [minimum computer specifications](#) recommended by NC State University and Engineering Online.

Course Delivery

- Face-to-Face: On Campus
- Distance Education: DELTA.
- Captured Lectures: This on campus course will be captured and distributed via the Internet and/or electronic media as part of the Engineering Online (EOL) program for distance students. These video recordings may contain an image of you entering the classroom, asking questions or being a part of the studio class. Please notify EOL if you DO NOT want your image to be included in the lecture presentation. If we do not hear from you after the first week of the class, we will assume that you are in agreement with this procedure.

Academic Integrity

- University policy on academic integrity: [Code of Student Conduct Policy \(POL11.35.01\)](http://policies.ncsu.edu/policy/pol-11-35-01) (<http://policies.ncsu.edu/policy/pol-11-35-01>). Violations of academic integrity will be handled in accordance with the [Student Discipline Procedures \(NCSU REG11.35.02\)](#). The unauthorized posting of any lecture notes, homework answers, exams, or any other course materials on third-party websites constitutes a violation of copyright as described in section 8.2 (f) of the Code of Student Conduct. Students posting such materials will be immediately referred to the Office of Student Conduct.

Supporting Fellow Students in Distress

As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remains a safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you. When this is the case, you are encouraged to report this behavior to NC State CARES: <https://prevention.dasa.ncsu.edu/nc-state-cares/about/>

Students with Disabilities

Reasonable accommodation will be made for students with verifiable disabilities. In order to take advantage of available accommodation, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State's policy on working with students with disabilities, please see [REG 02.20.01 – Academic Accommodations for Students with Disabilities – Policies, Regulations & Rules \(ncsu.edu\)](#)

Additional NC State Rules and Regulations

Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:

- Equal Opportunity and Non-Discrimination Policy Statement
<https://policies.ncsu.edu/policy/pol-04-25-05> with additional references at
<https://oied.ncsu.edu/divweb/policies/>
- Code of Student Conduct <https://policies.ncsu.edu/policy/pol-11-35-01>.