

NRE4350 Syllabus

[NRE Design Methods and Tools, Section A, 3 Credits]

[Class Day(s) T/Th, Time 1:30-2:45 PM, Location Room XXX XXX building]

Instructor Information

Instructor

Professor Bojan Petrovic

Email

bojan.petrovic@me.gatech.edu

Office Hours & Location

Tu 3:30 to 4:30 PM (prior notification by E-mail is recommended), or by appointment
Boggs building 3-07

Teaching Assistant(s)

None

Email

None

Office Hours & Location

None

General Information

Description

This course is the first course in a two course capstone design sequence in the NRE curriculum. This course introduce the students to selected methods and state-of-the-art analytic tools and computer code packages used in nuclear engineering. This course will prepare students for correct and effective use of nuclear engineering design methods and tools (computer codes) in the Senior Design course.

In the NRE Senior Design class, you will be assigned to perform an integrated NRE design of a reactor or a nuclear or radiological facility. You will be expected to perform adequate analyses. For most of design tasks that will require using relatively complex state-of-the-art tools. This course will prepare you for a correct and effective use of main nuclear engineering design methods and tools (computer codes), and will thus facilitate your Senior Design task.

Pre- &/or Co-Requisites

NRE 3208 or equivalent, NRE 3112 or equivalent

Pre-Requisite with Concurrency: NRE 4208 or equivalent, NRE 4214 or equivalent

Course Goals and Learning Outcomes

Upon successful completion of this course, students should be able to:

1. The student will develop a basic understanding of methods, applications and limitations of selected state-of-the-art tools used in nuclear and radiological engineering design
2. The student will develop a basic capability of using selected state-of-the arts tools and problem-solving skills within the context of nuclear engineering design.
3. The students will demonstrate an ability to effectively present results of their analyses in written reports.

Course Requirements & Grading

Assignment	Date	Weight (Percentage, points, etc)
Assignment 1	Week 1	10% of total grade
Assignment 2	Week 3	15% of total grade
Assignment 3	Week 5	15% of total grade
Assignment 4	Week 7	15% of total grade
Assignment 5	Week 9	15% of total grade
Assignment 6	Week 11	15% of total grade
Assignment 7	Week 13	15% of total grade

Description of Graded Components

Requirements and Assignments

There will be tentatively 7 assignments, requiring use of selected analytic tools. Typically, each assignment will require preparing model and input, running a simulation, extracting and interpreting results, and writing a report. The final grade is based on these reports. Each assignments will contribute toward the total combined score of up to 100% defining the final grade. Points and weight of each assignment will be specified with the assignment.

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

No curves should be anticipated for this course.

Course Materials

Course Text

Study materials will be provided in class and via T-square and Canvas.

Additional Materials/Resources

1. J.J. Duderstadt and L.J. Hamilton, Nuclear Reactor Analysis, John Wiley & Sons (1976)
2. W.M. Stacey, Nuclear Reactor Physics, (2nd ed.), John Wiley & Sons (2007)
3. N.E. Todreas, M.S. Kazimi, Nuclear Systems I/II, Taylor and Francis (2001); 2nd Ed. 2012

4. J.R. Lamarsh, Introduction to Nuclear Engineering, (2nd ed.) or J.R. Lamarsh and A.J. Baratta (3rd ed.), Prentice Hall (2001)
5. MCNP Manual, latest version
6. SCALE Manual, latest version
7. RELAP Manual, latest version
8. Library resources to look up journal papers and citations.

Course Website and Other Classroom Management Tools

T-square and Canvas will be used as the course website to communicate with the students.

Course Expectations & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, and <http://disabilityservices.gatech.edu/content/welcome-accommodate> as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

Attendance is mandatory first four weeks and strongly encouraged thereafter. Attendance may also be required on specific dates, as announced. While the attendance is not mandatory for the whole semester, in-class activity may inform a portion of the grade components.

Collaboration & Group Work

Discussion among students on understanding of the subjects and topics is encouraged. However, students are expected to prepare their own models and inputs, perform individual simulations, analyses and prepare reports, and turn in their own work for assignments. At all times students are expected to follow the Academic Honor Code (<http://www.catalog.gatech.edu/policies/honor-code/>)

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Submittals will be due strictly by the date and time announced, in the manner announced with each assignment, i.e., either by email to the instructor, or to TA, or upload to T-square or Canvas.

Each student can delay one submittal deadline (except the last assignment) by 72 hours, notifying the instructor by email at least 24 hours before the deadline. No reason needs to be provided and there will be no penalty in grading (if submitted within 72 hours; otherwise, zero points).

Any subsequent late assignments will not be accepted and missed exams will not be rescheduled without an Institute approved absence (e.g. field trips and athletic events). Students with medical or family emergencies should contact the Dean of Students. See <http://catalog.gatech.edu/rules/4/> for an articulation of the Institute rules.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Student Use of Mobile Devices in the Classroom

Use of portable technology during class time is not permitted unless prior arrangement has been made with the course instructor. Please leave your laptop in your bag, turn off your cell phone, and resist the urge to text your mom.

Additional Course Policies

The materials used in this class, including, but not limited to, exams, quizzes, homework assignments, and lectures are copyright protected works. Any unauthorized copying of the class materials is a violation of federal law and may result in disciplinary actions being taken against the student. This includes, among other things, uploading class materials to websites for the purpose of sharing those materials with other current or future students.

Campus Resources for Students

Academic Advisors (advising.gatech.edu/) in each school help students navigate degree requirements and take advantage of campus resources to ensure their success.

The **Center for Academic Success** (success.gatech.edu/) offers a variety of academic support services to help students succeed academically at Georgia Tech (e.g. tutoring, peer-led study groups, study skills, etc.).

The **Communication Center** (communicationcenter.gatech.edu/) provides support for students with respect to developing competency and excellence in written, oral, visual, electronic, and nonverbal communication.

The **Library** (library.gatech.edu/) provides students with many services besides borrowing privileges including access to technology and technical assistance, online access to many journals and databases, and subject and personalized research assistance.

The **Office of Disability Services** (disabilityservices.gatech.edu/) ensures that students with disabilities have equal access to all programs and activities offered at Georgia Tech. They provide documentation and officially sanctioned requests for accommodation for students

OMED: Educational Services (omed.gatech.edu/) is the unit charged by Georgia Tech with the retention, development, and performance of the complete student learner who is traditionally underrepresented: African American, Hispanic, and Native American. OMED's programming and academic support services are aimed at equipping all students with strategies to navigate the Georgia Tech environment.

The **Division of Student Life** (studentlife.gatech.edu/) – often referred to as the Office of the Dean of Students – offers resources and support for all students in our community.

Counseling Center	counseling.gatech.edu/	404-894-2575
Dean of Students	studentlife.gatech.edu/	404-385-8772
GT Police	police.gatech.edu/	404-894-2500
Stamps Health Services	health.gatech.edu/	404-894-1420

Course Schedule

Date	Topic	Notes (Reading, Notes, due dates, and more)
Week 1	Integrated design principles	Instructor based material.
Week 2 & Week 3	Basic tools Introduction to RSICC Overview of selected state-of-the-art tools Introduction to the Program's Computer Lab General principles of NRE simulations and analysis Physical quantities of interest Deterministic and stochastic simulations of nuclear systems Fixed source and eigenvalue simulations of nuclear systems Nuclear data libraries; continuous energy and multigroup simulations	Lectures will be accompanied by coding assignments and practice, independent study is expected
Week 4 & Week 5	Reactor physics analysis in integrated design Principles of analysis Introduction to specific analytic tool (e.g., MCNP) Analysis of simple critical systems Interpretation of results	Lectures will be accompanied by coding assignments and practice, independent study is expected
Week 6 & Week 7	Reactor physics analysis in integrated design (cont.) LWR typical fuel designs Analysis of representative fuel and reactor geometries (using e.g. MCNP) Interpretation of results	Lectures will be accompanied by coding assignments and practice, independent study is expected
Week 8 & Week 9	Reactor physics analysis in integrated design (cont.) Analysis of representative fuel and reactor geometries (using e.g. SCALE) Reactivity control Interpretation of results	Lectures will be accompanied by coding assignments and practice, independent study is expected
Week 10 & Week 11	Reactor physics analysis in integrated design (cont.) Fuel depletion analysis (using e.g. SCALE) Fuel reactivity and isotopics change Interpretation of results Fuel cycle analysis in integrated design Principles of analysis Simplified core depletion representation for fuel cycle analysis Linear reactivity model	Lectures will be accompanied by coding assignments and practice, independent study is expected

Date	Topic	Notes (Reading, Notes, due dates, and more)
Week 12 & Week 13	Shielding analysis in integrated design Principles of analysis Introduction to specific analytic tool(s) Interpretation of results	Lectures will be accompanied by coding assignments and practice, independent study is expected
Week 14 & Week 15	Thermal-hydraulics analysis in integrated design Principles of analysis Introduction to specific analytic tool(s) Interpretation of results	Lectures will be accompanied by coding assignments and practice, independent study is expected
Week 16	Review and discussion on final design class	