

NRE2120 Syllabus

[Elements of Nuclear Science and Engineering, Section A, 3 Credits]

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

Instructor Information

Instructor Professor Steven Biegalski	Email steven.biegalski@me.gatech.edu	Office Hours & Location Tu 12:30 to 1:30 PM (prior notification by E-mail is recommended), or by appointment Boggs building 3-375
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Teaching Assistant(s) None	Email None	Office Hours & Location None
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General Information

Description

Nuclear technologies have positive impact on society through clean electrical production, industrial applications, and medical practice. This course provides understanding of the fundamentals that influence the application of these technologies. This course covers nuclear and radiation engineering fundamentals and applications. Topics include basics of the atom, nuclear cross-sections, interaction rates, radioactive decay, and neutron multiplication. Applications include nuclear power, radiation detection, and nuclear medicine.

Pre- &/or Co-Requisites

MATH 1551 (minimum grade C) and Physics 2211 (with concurrency)

Course Goals and Learning Outcomes

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

1. summarize multiple applications of nuclear technologies in a wide range of disciplines including medicine, space exploration, power production, and military defense
2. explain the principles involved with generating power from nuclear fission
3. solve a limited set of real problems encountered in the nuclear engineering field
4. calculate neutron interaction rates in multi-element homogeneous media
5. calculate neutron criticality (k_{eff}) in multi-element homogeneous media

Course Requirements & Grading

Assignment	Date	Weight (Percentage, points, etc)
Final Exam (Comprehensive)	Final Exam Schedule	25% of total grade
Midterm Exam 1	Week 6	25% of total grade
Midterm Exam 2	Week 11	25% of total grade

Assignment	Date	Weight (Percentage, points, etc)
Quizzes, Homework, and Presentation.	Assigned weekly in class	25% of total grade
Bonus Opportunities	Entire Semester	≤ 5% of total grade

Description of Graded Components

Exams (75%)

There will be two in-class exams and one final exam. Exams will focus on material covered in class, homework problems, and previous quiz problems. Exams will include both quantitative and qualitative components. A typical exam will have 5 to 7 questions with the majority of problems being quantitative. All exams will be closed book and closed notes. Calculators will be allowed during exams. Academic dishonesty on exams will be taken very seriously.

Quizzes, Homework, and Presentation (25%)

Each week will have an assignment. Weeks with just a reading assignments will be followed by a quiz. All quizzes are in-class and there will be no opportunity for make-up quizzes. Most weeks will include homework assignments focusing on problems out of the text. Some homework problems will be created by the instructor. Each student will give one presentation during the course of the semester. Presentations will be approximately 5 minutes in length. While not required, visual aids that may include Power Point, websites, or other documents are suggested. A student produced video may also count as a presentation. Presentations may be on current events, opinions, or emerging technologies. All presentations should relate to course content. Students will sign up for presentation time slots during the first week of class. Quizzes, homework, and presentations will be given equal weight in final grading.

Homework assignments are due at the start of class on the day they are due. Students are encouraged to work collaboratively on homework, but each student must turn in their own unique completion of the assignment. If exact replications are submitted, the grade will be split among the students involved. In-class submission of homework is required unless prior consent of the instructor is obtained. No late homework will be accepted without an institute-approved absence.

Bonus Opportunities (≤5%)

Throughout the semester students may be given opportunities to obtain bonus credit for the course. Bonus opportunities may include attendance at seminars, external meeting participation, and other opportunities related to course content. There is no guarantee that students will receive bonus opportunities. Bonus participation is not required. The instructor is open to student suggestions on bonus opportunities.

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

Masterson R.E. (2017) *Nuclear Engineering Fundamentals A Practical Perspective* (CRC Press).

Additional Materials/Resources

Lamarsh J.R. and Baratta A.J. (2001) *Introduction to Nuclear Engineering (3rd Edition)* (Pearson) Other books, reviews, and papers indicated in lecture notes and/or posted on T-square. NOTE: Most lectures use outside sources in addition to (or instead of) the textbook.

Course Website and Other Classroom Management Tools

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 will not be mandatory, however, in-class activity including quizzes and a presentation will be a portion of the grade as described in the description of graded components.

Collaboration & Group Work

Students are expected to turn in their own work for assignments and quizzes, however, discussion among students on understanding of the subjects and topics is encouraged. 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

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	Introduction, History of Nuclear Science	Instructor based material.
Week 2	The Atom I,II	Chapter 1 of text.
Week 3	Neutrons and Other Particles I,II	Chapter 2 of text.
Week 4	Nuclear Interactions I,II	Chapter 3 of text.
Week 5	Nuclear Cross Sections, Nuclear Reaction Rates	Chapter 4 of text.
Week 6	Exam 1, Radioactive decay	(Exam covers weeks 1-5) Chapter 6 of text.
Week 7	Radioactive Materials	Chapter 6 of text
Week 8	Nuclear Fission and Chain Reactions I and II	Chapter 7 of text.
Week 9	Life of a Neutron and 6 Factor Formula I, II	Chapter 7 and 8 of text.
Week 10	Nuclear Reactor Fundamentals, Pressurized Water Reactor	Chapter 12, and 13 of text.
Week 11	SPRING BREAK	Have fun and be safe.
Week 12	Boiling Water Reactors, Exam II	Chapter 14 of text. (Exam covers weeks 6-12)
Week 13	Nuclear Fuel Cycle, Uranium Enrichment	Chapter 10
Week 14	Radiation Detectors I, II	Instructor based materials.
Week 15	Nuclear Medicine I, II	Instructor based materials.
Week 16	Student Presentation on Nuclear Topics	Instructor based materials.
Finals	Final Exam	Comprehensive