

Introduction to Nuclear Engineering

ENU 5005, Section INE3

Class Periods: Mondays and Wednesdays, Periods 3&4, 9:35-11:30 AM **Location:**

Monday: Black Hall, Room 0315; Wednesday: Weimer Hall, Room 1070 **Academic**

Term: Fall 2024

Instructor:

James E Baciak

jebaciak@mse.ufl.edu

352-273-2131

Office Hours: Monday, Period 8-9 :3:00 - 4:55 PM

Tuesday, Period 8-9: 3:00 - 4:55 PM

Friday, Period 5-6: 11:45 AM – 1:40 PM* 109

Nuclear Annex Building

Note: These times are subject to change during the first week of class to better accommodate schedules. Friday's office hours will be Zoom hours to better assist students that may prefer asking questions virtually (plus I will have travel that I need to accommodate for the Consortium for Nuclear Forensics and I will be backloading much of my travel to Thursdays and Fridays).

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

None

Course Description

Students will learn atomic and nuclear physics, interaction of radiation with matter, detecting nuclear radiation, neutron diffusion and moderation, nuclear reactor theory, time dependent reactor theory, and two-phase flow and heat transfer at a level appropriate to begin graduate-level coursework in nuclear engineering sciences.

Course Pre-Requisites / Co-Requisites

None.

Course Objectives

The course objectives include comprehension and proficiency in the following topics:

- Students will develop a familiarity with basic topics in atomic and nuclear physics
- Students will develop a familiarity with basic topics in interaction of radiation with matter
- Students will develop a familiarity with basic topics in detecting nuclear radiation
- Students will develop a familiarity with basic topics in neutron diffusion and moderation
- Students will develop a familiarity with basic topics in nuclear reactor theory
- Students will develop a familiarity with basic topics in thermal hydraulics

Materials and Supply Fees

None.

Relation to Program Outcomes (ABET):

Not Applicable.

Required Textbooks and Software

None. I will provide my notes.

Recommended Materials

- Atoms, Radiation and Radiation Protection, James E. Turner, 2007, Third Edition, ISBN 978- 3-527-40606-7. Free PDF available at <https://onlinelibrary.wiley.com/doi/book/10.1002/9783527616978>
- Fundamentals of Nuclear Engineering, J. Kenneth Shultis and Richard E. Faw, 2016, Third Edition, ISBN 978-1-498-76929-7
- Radiation Detection and Measurement, Glenn Knoll, 2010, Fourth Edition, ISBN 978-0-470-13148-0
- Introduction to Nuclear Engineering, John R. Lamarsh and Anthony J. Baratta, 2018, Fourth Edition, 0134570057
- Nuclear Systems I: Thermal Hydraulic Fundamentals, N.E. Todreas and M.S. Kazimi, 2011 (2nd edition). (ISBN: 9781439808870)

Required Computer

UF student computing requirement: <https://news.it.ufl.edu/education/student-computing-requirements-for-uf/>

Course Schedule

The course is broken into a set of modules:

- Module 1: Atomic and nuclear physics
- Module 2: Interaction of radiation with matter
- Module 3: Radiation detection
- Module 4: Neutron diffusion and moderation
- Module 5: Basic nuclear reactor theory
- Module 6: Basic Nuclear Thermal Hydraulics

Date		Course Topic
August	26	Introduction to Course; Radiation, radioactive decay, kinetics, units
	28	Binding energy, nuclear equations (Q-values)
September	2	No Class – Labor Day
	4	Radioactive series decay and equilibrium
	9	Photon interactions
	11	Heavy charged particles and electrons
	16	Neutron interactions, radiation dose, KERMA, fission
	18	Introduction to Radiation Detection
	23	Counting Statistics

	25	Gas detectors
	30	Scintillation detectors
October	2	Semiconductor detectors
	7	Neutron detectors
	9	Neutron cross sections
	14	Fission chain reaction and criticality
	16	Diffusion equation
	21	One-group reactor equation, slab reactor, other shapes
	23	One-group critical equation, thermal reactors
	28	Reflected reactors, multi-group calculations
	30	Classification of time problems, reactor kinetics
November	4	Control rods, chemical shim, temperature effects on reactivity
	6	Fission product poisoning, core properties during lifetime
	11	No Class – Veteran’s Day
	13	Averaging, parameters, transport in two-phase flow
	18	Modeling two-phase flow, pressure loss in two-phase flow
	20	Boiling, fundamentals, correlations, CHF
	25	No Class – Thanksgiving
	27	No Class - Thanksgiving
December	2	Heat transport in nuclear fuel, pellets, gap, clad
	4	Fluid mechanics and heat transfer, Single Channel Analysis
	9	
	11	
	12	FINAL EXAM (12:30-2:30 PM)

Attendance Policy, Class Expectations, and Make-Up Policy

Students are expected to attend each class period. Periods which may be missed should be brought to the attention of the Instructor as far in advance of the class period as possible. In the event of an unexcused absence, it is the student’s responsibility to obtain and review the material that was covered during that class period.

Late-work excuses can be grouped into the categories of professional, medical, and personal.

Professional: Reasonable extensions for job/internship interviews, technical conferences, or other professional/career development reasons should be requested. Requests are typically granted, at my discretion, unless they would grant a student or group of students an unfair advantage over their peers, cause significant disruption to the course or grading schedule, or violate some UF policy.

Medical: Extensions will also be granted for (your own) medical reasons – please do not come to class if you are ill. Per UF policy, in the case of medical absences that are frequent or suspiciously- timed (e.g.; you are repeatedly, suddenly ill at deadlines), I may request a signed note from a physician or similar professional practitioner.

Personal: In addition, UF policies require accommodation for several non-academic, non-medical reasons. Extensions for these personal issues are strictly limited to those mandated by the letter of UF policies. The list of UF-approved personal reasons changes from time to time. If you have a question regarding your personal issue and if it qualifies under one of the excused absence/late-work policies, contact me in advance.

The 12-day rule will be enforced strictly. Note that the count of days is based on a per-student, not per-approved-activity basis. All requests for excused absence or extension must be submitted in writing, preferably via e-mail.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies.

Excused absences must be consistent with university policies in the Graduate Catalog (<https://catalog.ufl.edu/graduate/regulations>) and require appropriate documentation. Additional information can be found here: <https://gradcatalog.ufl.edu/graduate/regulations/>

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (7-8)	Varies	20%
Tests	100	60%
Final Exam	100	20%
Total		100%

Assignments must be submitted electronically via Canvas. The following restrictions apply for submission:

- All submissions must be a single PDF document.
- If you do not have access to a physical scanner and you choose to use a phone or tablet to "scan" your handwritten document, you must use the free Adobe Scan app.
- Fully electronic alternatives include a PDF from Word with Equation Editor or LATEX.

The following penalties apply for late assignments:

- Late assignments submitted up to 24 hours after the due date will have 25% of the maximum possible points subtracted, except for excused absences as defined by university policy.
- Late assignments submitted more than 24 hours after the due date will receive no credit, except for excused absences as defined by university policy.

Grading Policy

Percent	Grade	Grade Points
93.0 - 100	A	4.00
89.0 - 92.9	A-	3.67
85.0 - 88.9	B+	3.33
82.0 - 84.9	B	3.00
79.0 - 81.9	B-	2.67
76.0 - 78.9	C+	2.33
72.0 - 75.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
62.0 - 65.9	D	1.00
59.0 - 61.9	D-	0.67
0 - 58.9	E	0.00

Since I do not curve the grading scale, all students can receive an A (or an E)! Note: this scale may be adjusted from semester-to-semester by a couple of points depending on topics covered and difficulty of exams.

More information on UF grading policy may be found at:

[UF Graduate Catalog](#)

[Grades and Grading Policies](#)

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University’s core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Coordinator
- HWCoe Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not

limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://elearning.ufl.edu/>.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling;
<https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.