

Reactor Analysis 1

ENU 6106 Section 1
Class Periods: M,W | Period 6 -7 (12:50 PM - 2:45 PM)
Location: MAT 0051
Academic Term: Fall

Instructor:

Dr. Justin Watson
178 Rhines Hall
Phone: 352-273-0241
Email: justin.watson@ufl.edu
Office Hours: By Appointment

Course TA:

None

Course Description:

(Official catalog version) Neutron reactions, fission and criticality for nuclear reactors. Analytical and numerical calculations for reactor design and analysis.

Course Pre-Requisites/Co-Requisites:

None

Course Objectives:

The focus of this course is an understanding of the modern practice of reactor physics. This entails both an understanding of classic deterministic reactor theory and concepts and governing equations that goes into computational Monte Carlo techniques, and how they are applied to the analysis of real reactors.

This course will require some facility with programming in a high level language (C++, FORTRAN, Matlab, Python, etc.) to solve problems related to radiation transport and to apply concepts learned into applied problems and evaluations (often as self-study or homework, the benefit of such exercises is thus highly dependent on the effort exerted by each student). You are responsible for familiarizing yourself with these topics.

Classical Reactor Physics

- Overview of Reactor Physics
- Basic Neutronics
- Transport Theory Derivation
- Diffusion Theory and Thermal Diffusion Length
- Reactor Eq. as Diffusion w/Fission Source & Time Coupled Modes
- Solutions of Reactor Eq. in different Geometries & 1.5 Group Theory
- Reflected Reactors, Self-Shielding, Homogenization

- Perturbation Theory and Intro to Adjoint
- Adjoint Operators and Derivation of Adjoint Transport Eq.
- Feedback and Reactivity Coefficients
- Reactor Kinetics Crash Course
- Further Reactor Kinetics

Advanced Topics

- Multi-Group Theory
- Core Design
- Fuel Cycle
- Transport Theory
- Core Power Distributions/Peaking
- Reactivity Control

Materials and Supply Fees:

None

Required Textbook and Software :

- Nuclear Reactor Analysis
- James J. Duderstadt and Louis J. Hamilton
- 1976
- 0-471-22363-8

Recommended Materials:

- Nuclear Reactor Physics
- Weston M. Stacey
- 2018, Third Revised Edition
- 978-527-41366-9

Lecture Materials:

Lectures will be given in person. Students are expected to attend all lectures.

Course Schedule:

See Modules Page.

Attendance:

Students are expected to attend all class lectures. Attendance will not be included in the grade however, material will be covered during the lectures not covered in the text. The use of cell phones is prohibited during the lectures. Laptops/tablets can be used for taking notes.

Excused absences must be in compliance with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.

Grading Policy:

There will be project/homework assignments and a final exam. Weights towards the final grade are as follows:

Homeworks = 40%
Project = 35%
Exams = 25%

Grades will be assigned according to the following scale and will be curved at the discretion of the instructor:

Grade	Percent	Grade Points
A	92 - 100	4.00
A-	88 - 91	3.67
B+	84 - 87	3.33
B	81 - 83	3.00
B-	78 - 80	2.67
C+	76 - 79	2.33
C	73 - 75	2.00
C-	70 - 72	1.67
D+	66 - 69	1.33
D	63 - 65	1.00
D-	60 - 62	0.67
E	0 - 59	0.00

Homework handed in up to 12 hours late will receive 30% off, homework handed in up to 24 hours late will receive 50% off. No homework will be accepted after 24 hours.

Requests for re-grading of any course document should be submitted as a written request within one week of the graded document being returned. After one week, re-grading requests will no longer be considered.

In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: A B- average is equivalent to a GPA of 2.67, and therefore, it

does not satisfy this graduation requirement. More information on UF grading policy may be found at: <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

Final Exam:

Final Exam: 12/11/2019 @ 12:30 PM - 2:30 PM

Students Requiring Accommodations:

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation:

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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 broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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 Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu

- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.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: <http://www.counseling.ufl.edu/cwc>, 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://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.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://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.