NPRE247: Modeling Nuclear Energy Systems

University of Illinois, Urbana-Champaign

Fall 2018

Instructor:	Prof. Kathryn Huff	**Time:**	MWF 10:00– 10:50
Email:	kdhuff@illinois.edu	**Place:**	225A Talbot Laboratory

Course Pages:

1. https://compass2g.illinois.edu
2. https://piazza.com/illinois/fall2018/NPRE247/home
3. https://classroom.github.com
4. https://github.com/katyhuff/npre247

TA Office Hours: The teaching assistant for the course, Mohammad Mustafa, will hold office hours Monday and Thursday from 1:00pm to 1:50pm in 220 Talbot Laboratory. Grade disputes will not be addressed in TA office hours.

CA Office Hours: The undergraduate course assistants for the course, Zoe Richter and Tyler Kennelly, will hold office hours Wednesdays from 1:00pm to 3:00pm in 123 Talbot Laboratory. Grade disputes will not be addressed in CA office hours.

Office Hours: Prof. Huff will hold office hours by appointment only and will never be available for an appointment with less than 24 hours notice. Before making an appointment, please try the following options:

- If your colleagues might be helpful, please post your questions in the forum provided for this purpose.
- If the TA or CAs might be helpful, please attend their office hours.
- Email Prof. Huff. If possible, please phrase your question such that it can be answered 'Yes' or 'No'. Questions which require substantial response should be asked during the lecture or office hours.

If none of the above are successful or appropriate, I am happpy to chat. Here's a url where you can pick a time and place that works for you: katyhuff.youcanbook.me. It syncs with my calendar. Once you've filled it out, we'll both receive an email that confirms the details.

Main References: A few essential references for this course will be assigned as readings. The required text for this course is [1] while [2] is also recommended. For assistance in computational projects, [3] is available online and in the library as an ebook.

[1] J. Kenneth Shultis and Richard E. Faw. *Fundamentals of Nuclear Science and Engineering*. CRC Press, Boca Raton, 3 edition edition, September 2016.

[2] John R. Lamarsh and Anthony J. Baratta. *Introduction to Nuclear Engineering*. Pearson, Hoboken, NJ, 4 edition edition, January 2017.

[3] Anthony Scopatz and Kathryn D. Huff. *Effective Computation in Physics*. O'Reilly Media, S.l., 1st edition, May 2015. https://www.safaribooksonline.com/library/view/effective-computation-in/9781491901564/.

Objectives: This course will equip students to:

- Apply elementary nuclear physics to nuclear engineering.
- Classify and compare nuclear reactor materials and components.
- Evaluate steady-state and transient operation of nuclear reactors.
- Calculate aspects of nuclear energy removal and conversion.
- Select and simulate radiation shielding.

Prerequisites:

- PHYS 212
- MATH 285 (credit or concurrent registration)

Grading Policy: Grades will be assigned as a weighted sum of the following work.

Work	**Weight**
Quizzes	(10%)
Homework	(15%)
Computer Projects	(30%)
Midterm 1	(15%)
Midterm 2	(15%)
Final Exam	(15%)
Total	(100%)

Important Dates:

Midterm #1 ..... Month Date, Year, Time
Midterm #2 ..... Month Date, Year, Time
CP1 Deadline ..... Month Date, Year, Time
CP2 Deadline ..... Month Date, Year, Time
CP3 Deadline ..... Month Date, Year, Time
Final Exam ..... Month Date, Year, Time

Class Policies:

Integrity: This is an institution of higher learning. You will be swiftly ejected from the course if you are caught undermining its integrity. Note the Student's Quick Reference Guide to Academic Integrity and the Academic Integrity Policy and Procedure.

Attendance: Regular attendance is mandatory. Request approval for absence for extenuating circumstances prior to absence.

Electronics: Active participation is essential and expected. Accordingly, students must turn off all electronic devices (laptop, tablets, cellphones, etc.) during class. Exceptions may be granted for laptops if engaging in computational exercises or taking notes.

Collaboration: Collaboratively reviewing course materials and studying for exams with fellow students can be enriching. This is recommended. However, unless otherwise instructed, homework assignments are to be completed independently and materials submitted as homework should be the result of one's own independent work.

Late Work: Late work will not be accepted. Plan ahead. An optional homework assignment and an optional quiz will each be offered during Fall Break. These optional assignments can be completed to replace your lowest grade in each category. This shall accomodate unforseen circumstances and corresponding missed quizzes and homeworks.

Make-up Work: There will be no negotiation about late work except in the case of absence documented by an absence letter from the Dean of Students. The university policy for requesting such a letter is in the Student Code. Please note that such a letter is appropriate for many types of conflicts, but that religious conflicts require special early handling. In accordance with university policy, students seeking an excused absence for religious reasons should complete the Request for Accommodation for Religious Observances Form The student should submit this form to the instructor and the Office of the Dean of Students by the end of the second week of the course to which it applies.

Grade Disputes: It is important that you understand and agree with the grade you receive on assignments and exams. If you would like to dispute your score, you must send an explanation by email to Prof. Huff within one week of recieving the grade. **Do not expect us to regrade anything while in conversation with you** as that would not be fair to the other students in the class, whose homeworks were graded without them present. If you request a regrade, be aware that the entire assignment will be regraded and is subject to double-jeopardy: it is possible that your score will go down. Regrade requests should be based on an error on our part (e.g., adding up the points incorrectly) or what you suspect is a misunderstanding of your work (e.g., arriving at the correct answer using an unexpected technique). Regrade requests that argue with the rubric (e.g., "this is wrong, but you took too many points off") will be returned without consideration. **Your work should stand alone.** If an assignment is disorganized or ambiguous, and requires an extensive explanation to the grader, you will likely still lose points. The homeworks not only evaluate your understanding of the material - they also evaluate your ability to communicate that understanding clearly and concisely.

Accessibility: I hope that this course will be inclusive and accommodating for all learners. As such, I am committed upholding the vision and values of Inclusive Illinois in my classroom. With regard to accommodating all learners, please note that many resources are provided through the Division of Disability Resources and Educational Services. To request particular accommodations, please contact me as soon as possible so that we can work out any necessary arrangements.

Other Resources: University students typically experience a wide range of stressors during their time on campus. Accordingly, campus resources exist to help students manage stress levels, mental health, physical health, and emergencies while navigating this environment. I hope you will take advantage of these campus resources as soon as they can be of help.

- The Campus Recreational Centers
- The Counselling Center
- The McKinley Mental Health Clinic
- The Emergency Dean

Course Schedule: *Note that this schedule is subject to change.*

Date	Week	Day	Unit	Chap.	Quiz Given	Date Due	HW Given	HW Due
8/27	1	M	Intro		1		1	
8/29	1	W	Fundamentals	1				
8/31	1	F	Fundamentals	1			2	1
9/3	2	M	**Labor Day**		2	1		
9/5	2	W	Modern Physics	2				
9/7	2	F	Modern Physics	2			3	2
9/10	3	M	Nuclear Models	3	3	2		
9/12	3	W	Nuclear Energetics	4				
9/14	3	F	Nuclear Energetics	4			4	3
9/17	4	M	Radioactivity	5	4	3		
9/19	4	W	Radioactivity	5				
9/21	4	F	Radioactivity	5			5	4
9/24	5	M	Review		5	4		
9/26	5	W	Exam 1					
9/28	5	F	Binary Nuc. Rxns.	6			6	5
10/1	6	M	Binary Nuc. Rxns.	6	6	5		
10/3	6	W	Binary Nuc. Rxns.	6				
10/5	6	F	Rad. Int. with Matter				7	6
10/8	7	M	Rad. int. with Matter	7	7	6		
10/10	7	W	Radiation Dosimetry	9				
10/12	7	F	Radiation Dosimetry	9			8	7
10/15	8	M	Radiation Dosimetry	9	8	7		
10/17	8	W	Neutron Balance	notes				
10/19	8	F	Criticality	notes			9	8
10/22	9	M	Criticality	notes	9	8		
10/24	9	W	6 Factor	10				
10/26	9	F	6 Factor	10			10	9
10/29	10	M	6 Factor	10	10	9		
10/31	10	W	Exam 2					
11/2	10	F	Reactor Materials				11	10
11/5	11	M	Reactivity Feedback	10	11	10		
11/7	11	W	Reactivity Feedback	10				
11/9	11	F	Reactivity Feedback	10			12	11
11/12	12	M	Fission Prod. Poison		12	11		
11/14	12	W	Fisison Prod. Poison					
11/16	12	F	Open				< 13 >	12
11/19	13	M	**Fall Break**		< 13 >	12		
11/21	13	W	**Fall Break**					
11/23	13	F	**Fall Break**				14	< 13 >
11/26	14	M	Neutron Diffusion	10	14	< 13 >		
11/28	14	W	Neutron Diffusion	10				
11/30	14	F	Neutron Diffusion	10			15	14
12/3	15	M	Neutron Diffusion	10	15	14		
12/5	15	W	Neutron Diffusion	10				
12/7	15	F	Neutron Diffusion	10				15
12/10	16	M	Nuclear Electric Power			15		
12/12	16	W	Ethics					
12/14	16	F	Review					
12/17	17	M	**Final Exam**					