Course Syllabus

Course Information

PHYSICS OF NUCLEAR REACTORS		MANE 4480	Section 1
RPI Fall 2023	4 cr		
Lecture	MR	2:00PM-3:50PM	JONSSN 4304

Prerequisites or Other Requirements:

MANE-2400 or equivalent

Instructor

Professor Yaron Danon	Email: danony
Office Location: NUCENG 1-9	Phone: (518) 276-4008
Office Hours: W 10:00AM-12:00AM via WebEx	http://homepages.rpi.edu/~danony/PNR/PNR.html

Teaching Assistant(s)

Name	Office	Office Hours	Email Address
Haque Md Marjanul	JEC 5219	Thursday 12-2 pm	haquem3

Course Description

The course will introduce basic nuclear reactor theory. It will focus on neutron transport methods, neutron diffusion and slowing down, criticality analyses for homogeneous and heterogeneous systems, reactor kinetics and control, reactivity coefficients, reactor systems and types, reactor design and reactor safety.

Course Text(s)

Duderstadt and Hamilton, “Nuclear Reactor Analysis”, John Wiley and Sons, 1976.
Lecture notes provided by instructor.

Additional References

1. John R. Lamarsh, “Introduction to Nuclear Reactor Physics”, Addison-Wesley, 1966.
2. George Bell, Samuel Glasstone, “Nuclear Reactor Theory”, Robert E. Krieger Publishing, 1985.
3. Weston M. Stacey, “Nuclear Reactor Physics”, John Wiley & Sons Inc. 2001

Required Software

SMath Studio or MathCad are required for all HW assignments.

Course Goals / Objectives

Learn the fundamentals of neutronic and physics as it pertains to nuclear reactors.

Course Content

The course will concentrate on the neutronics of thermal nuclear reactors. The topics will cover neutron reactions and cross sections, the transport equation, the diffusion equation, solutions of the diffusion equation, criticality, multigroup methods, fast and thermal spectrum calculations, reactor kinetics, and heterogeneous lattice calculations.

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Student Learning Outcomes

1. Be able to calculate neutron interaction probabilities.
2. Demonstrate setup and solution of the diffusion equation in different geometries.
3. Demonstrate calculations of the multiplication factor in one and two groups.
4. Demonstrate calculations for numerical solution of the diffusion equation.
5. Be able to solve the neutron slowing down equation.
6. Demonstrate calculations of resonance integrals and resonance escape probabilities.
7. Be able to solve the time dependent neutron equation.
8. Be able to write and use solutions of the point kinetic equations.
9. Demonstrate understanding of basic concepts in heterogeneous systems.

Course Assessment Measures

Assessment	Due Date	Learning Outcomes
Homework (~8)	1 week after assigned	1, 2, 3, 4, 5, 6, 7, 8, 9
Mid Term Exam	TBD	1, 2, 3
Final Exam	TBD	1, 2, 3, 4, 5, 6, 7, 8, 9

Grading Criteria

Based on a weighted sum of the homework, midterm, and final exams, as follows:
CG=0.4(average homework grade) + 0.3 (midterm exam grade) + 0.3(final exam grade)
CG is the course grade in a scale from 0 to 100, it will be converted to a letter scale by the following rules:

From	To	Final Grade
93	100	A
90	92	A-
87	89	B+
83	86	B
80	82	B-
77	79	C+

From	To	Final Grade
73	76	C
70	72	C-
60	69	D+
56	59	D
0	55	F

Attendance Policy

Not required, however it is the student's responsibility to be aware of homework assignments and examinations. Regular attendance is strongly recommended.

Academic Integrity

Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts which violate this trust, undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty, and you should make yourself familiar with these. **In this class, all assignments that are turned in for a grade must represent the student's own work**. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration. Submission of any assignment that is in violation of this policy will result in a grade reduction penalty. Late homework submission will also result in grade reduction penalty (to be discuses during the first class). If you have any questions concerning this policy before submitting an assignment, please ask for clarification.

Diversity and Inclusion

At RPI we support an inclusive learning environment where diversity and individual differences are understood, respected, appreciated, and recognized as a source of strength. I expect that students and faculty will respect differences and demonstrate diligence in understanding how other peoples' perspectives, behaviors, and world views may be different from their own. Students in this class are encouraged to speak up and participate during class. Because the class will represent a diversity of individual beliefs, backgrounds, and experiences, every member of this class must show respect for every other member of this class.