

NEEP 411 | NUCLEAR REACTOR ENGINEERING
Course Syllabus

FALL 2014: Monday - Wednesday - Friday - 8:50am to 9:40am – Engineering Hall 2540

INSTRUCTOR: Raluca Scarlat, ERB 437 (608-263-6974)
Office Hours – see Piazza page

GRADER: Kalin Kiesling, ERB 428 (kkiesling@wisc.edu)

CLASS WEBSITE: https://piazza.com/uw_madison/fall2014/ne411/home
If you did not already receive an invitation to join the Piazza course website, just go to the website and click “Enroll in Course” (very top right of the screen). The enrollment code is **NE411**.

COURSE GOALS:

- Ability to apply mathematics, science and engineering principles to engineering problems pertaining to the design and analysis of nuclear reactors.
- Ability to critically review engineering analysis performed by others, pertaining to nuclear reactors
- Sufficient familiarity with conventional and advanced nuclear reactor systems to identify, formulate and solve engineering problems pertaining to the design and analysis of nuclear reactors.

BRIEF LIST OF TOPICS TO BE COVERED:

Phenomenology

Steady and transient conduction heat transfer

Mechanical and thermal stress in solids

Single phase convection, pressure drop and flow distribution

Two-phase heat transfer and flow fundamentals, critical heat flux

Reactor Systems

System characteristics of Gen II, III and III+ PWRs and BWRs

System characteristics and pertinent phenomenology of non-LWR reactors

Severe reactor accident evolution: case studies

Passive and intrinsic reactor safety features: case studies

HOMEWORK: Assignments usually handed out weekly on Fridays and due one week later at the beginning of class. No late homework is accepted, unless deadline extension is requested in advance. Once you’ve received your graded homework, you can correct and complete your answers, and resubmit for a re-grade; only the latest grade counts. You can resubmit as many re-grades as you wish until the beginning of class on Dec 12th.

EXAMS: Probably two midterms plus comprehensive final exam

GRADING: Midterms: 40% Homework: 25% Final exam: 35%
Grading Policy: A: 90-100; B: 80-90; C: 70-80; D: 60-70

REQUIRED TEXT: Nuclear Heat Transport - El-Wakil (obtain at bookstore)
Handouts provided in the classroom and posted on class website

ADDITIONAL SUGGESTED TEXTS:

Check the course website weekly for updates this list. I also welcome you to contribute to this list. The library and the online scholarly literature have a wealth of material on each of the topics that we cover in the class. I expect you to be proactive in finding some of your own learning material, and I encourage you to share with the class once you come across a particularly useful reading.

Nuclear Systems - Todreas and Kazimi (Hemisphere Pub)
Transport Phenomena - Bird, Stewart, and Lightfoot (Wiley)
Principles of Heat Transfer - F. Incropera (McGraw Hill)

RESERVE TEXTS:

A copy of El-Wakil should be on reserve at the Wendt library over the next couple of days. If you find me in my office, you're welcome to stop by and use my copy.

The honor system applies for all work and activities related to this class, and academic integrity is expected. Please refer to [The Academic Integrity Statement](http://students.wisc.edu/doso/acadintegrity.html) of UW-Madison Division of Student Life. (<http://students.wisc.edu/doso/acadintegrity.html>)

TENTATIVE COURSE SCHEDULE

WEEK	TOPIC	READING
Wk 1 9-3	Heat Generation in Nuclear Systems	Chap. 4
Wk 2 9-8	Conduction: 1D Steady-state	Chap. 5, 6
Wk 3 9-15	Conduction: 1D Transient	Chap. 8
Wk 4 9-22	Conduction: 2D/3D Steady-state & Transient	Chap. 7
Wk 5 9-29	Thermally Induced Stresses	Handout
Wk 6 10-6	<i>MIDTERM #1: Solids - Conduction and thermal stresses</i>	
Wk 7 10-13	Single Phase Convection	Chap. 9, 10
Wk 8 10-20	Multiphase Flow - Pressure Drop, Critical Flow	Chap. 11, 12
Wk 9 10-27	Multiphase Heat Transfer: Boiling and Condensation	Handout
Wk 10 11-3	Buoyancy-Driven Flow	Handout
Wk 11 11-10	<i>MIDTERM #2: Fluids – Convection and flow</i>	
Wk 12 11-17	Core Thermal Design	Chap. 13
Wk 13 11-24	Severe reactor accident evolution: case studies	
Wk 14 12- 1	Passive and intrinsic reactor safety features: case studies	
Wk 15 12-8	Case studies	
12-20	FINAL EXAM: Check Schedule	

*Is there a topic that you'd like covered in this course that's not already on the syllabus?
Let me know – post a message on Piazza – and I'll see if a module can be added.*