Introduction to Nuclear Reactor Materials

ENU 4800 Section 06FA
Class Periods: T (Periods 2, 8:30AM-9:20AM), R (Period 2-3, 8:30AM-10:25AM)
Location: WEIL 0234
Academic Term: Spring 2026

Instructor:
Professor Yong Yang
yongyang@ufl.edu
352-846-4791
Office Hours: Monday, 12-1 pm (subject to changes based on student availability)

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- N/A.

Course Description
Introduction to the materials used in nuclear energy systems and their response to the reactor environment. Most materials related issues encountered in the nuclear power plants are discussed in this course.

Course Pre-Requisites / Co-Requisites
EMA 3010 Materials

Course Objectives
To provide the students with a comprehensive knowledge on the types of materials used in nuclear reactors, their response to the reactor environments and most of the materials problems encountered in the operation of nuclear power reactors for energy production.

Materials and Supply Fees
N/A

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Low
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Medium

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Low
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

None required. Course notes and suggested reading materials will be made available on the Canvas course website.

Recommended Materials

- Fundamentals of Radiation Materials Science: Metals and Alloys, G. Was, Springer Berlin 2007, ISBN 978-3-540-49472-0.
- Light Water Reactor Materials, Volume I: Fundamentals, A.T. Motta, D.R. Olander, ANS 2017, ISBN: 978-0-89448-461-2
- Light Water Reactor Materials, Volume II: Applications, A.T. Motta, D.R. Olander, ANS 2021, ISBN: 978-0-89448-467-4
- The Mayfield Handbook of Technical and Scientific Writing (available at http://www.mhhe.com/mayfieldpub/tsw/toc.htm)

Required Computer

Recommended Computer Specifications: https://it.ufl.edu/get-help/student-computer-recommendations/
HWCOE Computer Requirements: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/

Course Schedule

Week 1 (January 12): Course Introduction and Overview of Materials in Nuclear Reactor
Week 2 (January 19): Materials Basis: Crystal structure, point defects in solids (HW1)
Week 3 (January 26): Materials Basis: dislocation, grain boundary, diffusion
Week 4 (February 2): Materials Basis: mechanical properties and performance (HW2) (Quiz #1)
Week 5 (February 9): Radiation damage: collision theory, cross sections, energy loss
Week 6 (February 16): Radiation damage: Range, displacement, ion, neutron damage (HW3)
Week 7 (February 23): Radiation damage: microstructural development
Week 8 (March 2): Radiation damage: impacts on material's mechanical property (HW 4) (Quiz #2)
Week 9 (March 9): Fuel: chemistry, fabrication, burnup (HW 5)
Week 11 (March 16): Spring Break
Week 10 (March 23): Fuel: Fission products and its impacts I
Week 12 (March 30): Fuel: Fission products and its impacts II (HW6, Quiz #3)
Week 13 (April 6): Corrosion: thermodynamics
Week 14 (April 13): Corrosion Kinetics (HW7)
Week 15 (April 20): Quiz #4

Important Dates

Listed above in the course schedule

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Attendance	5**	5%
Homework Sets (7)	100 each	35%
Quizzes (4)	100 each	40%
Final Project	100	20%

		100%

** 5 points for no unexcused absences, 4 points for one unexcused absence, 3 points for two unexcused absences, and 0 points for three or more unexcused absences.

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

Attendance Policy, Class Expectations, and Make-Up Policy

Students are expected to attend all lectures, and the unexcused absences will impact the final grade as explained in "Evaluation of Grade" table. Any anticipated absence should be communicated to the instructor as far in advance as possible. Proper behavior in class is required, eating, texting, chatting, or other activities that are not part of the class are not allowed. Students who do not comply with these requirements or who behave disorderly or disrespectfully may be asked to leave the classroom. Cell phones and other electronic devices must be completely silence or turned off.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:
https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive 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.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:
- Your academic advisor or Undergraduate 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