Introduction to Nuclear Reactor Materials
ENU 6805  Section 15CF

Class Periods:  M W F, 4, and 9:35AM-10:25AM
Location:  Weil 0279
Academic Term:  Fall

Instructor:
Yong Yang
yongyang@ufl.edu
352-846-3791
Office Hours:  Monday, 1-3pm, zoom

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website
None

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

Course Pre-Requisites / Co-Requisites
Be specific and indicate if equivalent courses or instructor permission is relevant. This must match the catalog for approved courses

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
None.

Required Textbooks and Software
No required textbook, and the course notes will be posted online.

Recommended Materials

- Fundamentals of Radiation Materials Science
  - Author: Gary Was
  - Publication: Springer

- Fundamental aspects of nuclear reactor fuel elements,
  - Author: Donald R. Orlander
  - Publication: University of Michigan Library
  - ISBN: 0870790315

- Nuclear Reactor Materials and Applications
  - Author: B. Ma
  - Publication: Springer
  - ISBN-10: 0442225598
- Principles and prevention of corrosion, 2nd edition
  - Author: Denny A. Jones
  - Publication: Prentice Hall, 1996
  - ISBN: 0-13-359993-0
- Corrosion Engineering
  - Author: Branko N. Popov
  - Publication: Elsevier

**Course Schedule**

**Introduction and Materials Basis**

- **Week 1:** Course Introduction, General Survey of Materials in Nuclear Reactors
- **Week 2:** Materials Basis, crystal structure, point defects, dislocation, grain boundary
- **Week 3:** Materials Basis, diffusion
- **Week 4** Materials Basis, mechanical properties

**Radiation Damage**

- **Week 5** Radiation Damage, defect production
- **Week 6** Radiation Damage, rate theory, SRIM and DPA calculation

**Corrosion**

- **Week 7** Corrosion, introduction and stability of materials
- **Week 8** Corrosion, thermodynamics and kinetics
- **Week 9** Passivity, galvanic corrosion, pitting, crevice corrosion,
- **Week 10** Stress corrosion cracking, and Irradiation Assisted SCC
- **Week 11** Corrosion in supercritical water, molten salt and liquid metals

**Nuclear Fuels**

- **Week 12** Nuclear fuels, introduction and overview
- **Week 13** Reactor fuels, fission yields, and fuel chemistry
- **Week 14** Densification, swelling, creep, and thermal analysis
- **Week 15:** Fuel failure mechanism and performance evaluation

**Attendance Policy, Class Expectations, and Make-Up Policy**

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 silenced or turned off.

Attendance is required and will be monitored using signup sheets, and your attendance records will be available on Canvas. Five or more un-excused absences will result in a deduction of 20 points from your final grade.

Excused absences must be consistent with university policies in the Graduate Catalog ([https://catalog.ufl.edu/graduate/regulations](https://catalog.ufl.edu/graduate/regulations)) and require appropriate documentation. Additional information can be found here: [https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/](https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/)

If a student who is withheld from campus attends class, the student should be asked to leave the classroom and be reported to the Dean of Students Office.

**Evaluation of Grades**
<table>
<thead>
<tr>
<th>Assignment</th>
<th>Total Points</th>
<th>Percentage of Final Grade</th>
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<tbody>
<tr>
<td>Homework Sets (3)</td>
<td>100 each</td>
<td>30%</td>
</tr>
<tr>
<td>In Class Exam #1</td>
<td>100</td>
<td>15%</td>
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<tr>
<td>In Class Exam #2</td>
<td>100</td>
<td>15%</td>
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<tr>
<td>In Class Exam #3</td>
<td>100</td>
<td>15%</td>
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<tr>
<td>Final paper and presentation</td>
<td>100</td>
<td>25%</td>
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<td>100%</td>
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**Grading Policy**
The following is given as an example only.

<table>
<thead>
<tr>
<th>Percent</th>
<th>Grade</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>90.0 - 100.0</td>
<td>A</td>
<td>4.00</td>
</tr>
<tr>
<td>87.0 - 89.9</td>
<td>A-</td>
<td>3.67</td>
</tr>
<tr>
<td>84.0 - 86.9</td>
<td>B+</td>
<td>3.33</td>
</tr>
<tr>
<td>81.0 – 83.9</td>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>78.0 - 80.9</td>
<td>B-</td>
<td>2.67</td>
</tr>
<tr>
<td>75.0 - 79.9</td>
<td>C+</td>
<td>2.33</td>
</tr>
<tr>
<td>72.0 – 74.9</td>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>69.0 - 71.9</td>
<td>C-</td>
<td>1.67</td>
</tr>
<tr>
<td>66.0 - 68.9</td>
<td>D+</td>
<td>1.33</td>
</tr>
<tr>
<td>63.0 - 65.9</td>
<td>D</td>
<td>1.00</td>
</tr>
<tr>
<td>60.0 - 62.9</td>
<td>D-</td>
<td>0.67</td>
</tr>
<tr>
<td>0 - 59.9</td>
<td>E</td>
<td>0.00</td>
</tr>
</tbody>
</table>

More information on UF grading policy may be found at:
[http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades](http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades)

**Students Requiring Accommodations**
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting [https://disability.ufl.edu/students/get-started/](https://disability.ufl.edu/students/get-started/). It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

**Course Evaluation**
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at [https://gatorevals.aa.ufl.edu/students/](https://gatorevals.aa.ufl.edu/students/). Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via [https://ufl.bluera.com/ufl/](https://ufl.bluera.com/ufl/). Summaries of course evaluation results are available to students at [https://gatorevals.aa.ufl.edu/public-results/](https://gatorevals.aa.ufl.edu/public-results/).

**In-Class Recording**
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor...
hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

**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 Conduct Code ([https://sccr.dso.ufl.edu/process/student-conduct-code/](https://sccr.dso.ufl.edu/process/student-conduct-code/)) specifies a number of behaviors that are in violation of this code and the possible sanctions. 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
- Jennifer Nappo, Director of Human Resources, 352-392-0904, [jpenacc@ufl.edu](mailto:jpenacc@ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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](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.

You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

Counseling and Wellness Center: https://counseling.ufl.edu, 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.


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/.
