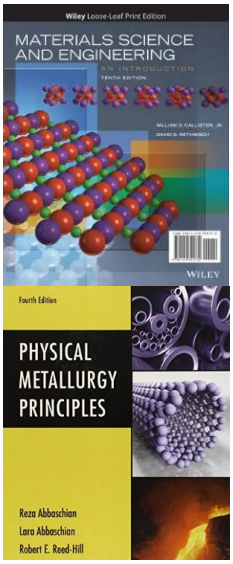
Course Information

Fall 2025 NUCL 320, Introduction To Materials For Nuclear Applications

Course Description

This course covers the material science basics that are needed to understand and solve nuclear material problems. The learning experience will focus on the material principles, including the concepts of structure from atomic bonding to microstructure, and the relations between microstructure and properties The course includes 4 major sessions, including crystal structures, defect structures, diffusion and phase transformation, and material properties in nuclear environments. Through this course, students are able to develop the basic understandings of the process-microstructure-property relationships of nuclear materials and evaluate the mechanical safety of materials in nuclear environments. The course is designed in parallel with NUCL325 Nuclear Materials Laboratory so both courses can be taken in the same semester.

Textbook



Main Learning Resources:

- Lecture Slides and Handouts (Teaching materials are shared with students via Brightspace. You are responsible for attending classes and taking effective notes.)
- Materials Science and Engineering: An Introduction, 10th Edition, William D. Callister Jr., David G. Rethwisch

Other reference:

- Physical Metallurgy Principles, 4th edition, Abbaschian, Abbaschian and Reed-Hill

Course Materials Policy

- All the teaching and assignment materials in this course are intended only for authenticated users who are enrolled for NUCL 320 in Fall 2024. Release of any these materials without obtaining written consent from the professor will be regarded as a violation of academic integrity.
- Recording, photographing, and releasing of the materials to the public domain without professor's written consent are prohibited and will be regarded as a violation of academic integrity.
- All course notifications, including corrections and schedule changes, will be posted as announcement in Brightspace and not sent via email. It is the student's responsibility to regularly check for updates and notifications in Brightspace.

Learning Outcomes

- Learn the materials basics which are related to the mechanical performance of nuclear materials
- Understand the process-microstructure-property relationship
- Apply the material engineering principles to solve the conceptual and analytical problems related to material design, processing, and structural safety

Assignments

Assignments	Percentage Weight
Homework	15%
Exam 1	20%
Exam 2	20%
Exam 3	20%
Final Exam	25%
Attendance	2%
Total	***102%***

- Professor and graders will respond to your request by email. Regarding your grades, please talk to graders first.
- Four exams will be given in class throughout the semester. The final exam is comprehensive for the whole semester.
- Any disputes regarding grades must be submitted in writing to the professor and graders within one week of the return of the assignment. Disputes submitted after one week will not be considered.
- Late homework without approved excuses will be docked 20% per day until 100%. No late submission will be accepted beyond 5 days.
- Acceptable late submission excuses include medical related reasons and school business. The request needs to be sent to professor and copied to graders before the assignment due date.
- Any assignments that include plagiarized materials will receive a grade of zero.
- Only the professor can excuse a student from a course requirement or responsibility. The teaching assistant cannot.
- Your attendance will be randomly checked (>10 records). If you miss one check without permission, you lose the attendance points.
- Students are expected to attend all classes unless prior permission for absence from the instructor. Your request for permission due to medical reason or school business needs to be sent to me on the day of the class that you expect to miss.
- Students who are absent from or arrive late to lectures are responsible for all materials covered during the lectures, as well as any missed assignments.
- Students who need special accommodations are encouraged to email me and talk to me after the class so we can discuss your situation confidentially.

Grading Scale

Percent Grade	Letter Grade
97 – 100	A+
93 – 96.99	A
90 – 92.99	A-
87 – 89.99	B+
83 – 86.99	B
80 – 82.99	B-
77 – 79.99	C+
73 – 76.99	C
70 – 72.99	C-
67 – 69.99	D+
63 – 66.99	D
60 – 62.99	D-
< 60	F

Note: Grade may be curved if the median of the class is too low. We are targeting a median above 80.

Emergency Preparation

In the event of a major campus emergency, the course requirements, deadlines, and grading percentages may be subject to changes that are necessitated by a revised semester calendar or other circumstances beyond the professor's control. Any relevant changes to this course will be posted on Brightspace. It is your responsibility to regularly check Brightspace for updates on any changes made to the course. Please note that email notifications will not be sent for these updates.

Course Schedule

Week	Topic	Book Chapter	Exam
Wk1 (8/25)-Wk2 (9/1)	Mechanical Properties	6	
Wk2 (9/1)-Wk3 (9/8)	Cystal Structure	3	
Mid Sep.			Exam 1
Wk4 (9/15)	Imperfections and defects	4	
Wk4 (9/15) – Wk8 (10/13)	Dislocations and Strengthening	7	
Mid Oct.			Exam 2
Wk8 (10/13) – Wk9 (10/20)	Diffusion	5	
Wk9 (10/20) – Wk11 (11/3)	Phase Diagram	9	

Wk11 (11/3) – Wk12 (11/10)	Phase Transformation	10	
Mid Nov.			Exam 3
Wk13 (11/17) – Wk15 (12/1)	Failure	8	
Wk15 (12/1) – Wk16 (12/8)	Nuclear Materials	-	
Wk16 (12/8)	Radiation Damage	-	
Final Week			Final Exam

Note: Schedule subject to change.

Homework and Exam

- Homework assignments can be worked in groups, but must be each student's own work. HW will be uploaded in PDF format via Brightspace and will be graded. After grading, HW solutions will be reviewed in class.
- This course will treat academic honesty very seriously. If the graders report dishonesty behavior such as cheating, plagiarism, copying others' work, you will receive zero on the related assignment and get warning for the first time. For the second time, we will report to University.
- Homework solutions will NOT be posted on Brightspace. You need to come to the review session or borrow notes from others.
- Your homework PDF file should be named in the form of "HW#-your last name" so I can track. You also need to have your name, homework number, page number on your homework.
- Exam solutions will NOT be posted on Brightspace. You need to come to the review session or borrow notes from others.
- Exams will be given in class.

NUCL320
Homework Guidelines

To help engineering students develop the proper discipline for future professional practice, the following standards must be followed when completing homework for submission.

- Your homework front page should include:
  - Your Name
  - NUCL320
  - HW Set Number
  - Date

- Multiple sheets must be combined to a single **PDF file**

- Homework file should be named in the form of **"HW#-your last name"**.

- All calculations must be appropriately sized, legible, clean, orderly, neat, etc. Do not make the mistake of trying to cram everything into as small a space as possible.

- All drawings, figures and/or graphs must be appropriately sized, legible, clean, orderly, neat, etc. Computer generated drawings, figures and graphs are best. Crude freehand drawings are not acceptable.

- Answers must be clearly identified (boxed, double underlined, etc.)

- Units: Most engineering calculations involve units (lb, kg, etc.). Much insight can be gained and many calculation errors can be prevented by canceling units during the calculation procedures. Final answers must have the appropriate units.

- Significant digits: Do not simplemindedly write down all the digits that your mindless calculator provides. Ensure that the significant digits of your final answer are consistent with those of the problem statement.