# NE 733 Course Syllabus

Advanced Reactor Materials and Materials Performance

Fall 2024

## Instructor Information

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| --- | --- | --- | --- |
| Name | Office Phone | Email | Office Location |
| Benjamin Beeler | 919-515-3737 | [bwbeeler@ncsu.edu](mailto:bwbeeler@ncsu.edu) | BU 1110C |

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### Office Hours

Wednesdays from 10am-11am. In-person or virtual. Contact in advance for virtual option via zoom. Alternate office hours available on request.

## Course Information

**Course Website**: [Moodle](https://moodle-courses2324.wolfware.ncsu.edu/course/view.php?id=3215)

**Meeting Time and Location:** Tu/Th 1:30-2:45; BU 1202

**Course Credit Hours**: [3]

### Catalog Description

This course discusses materials evolution and performance in advanced reactor systems, addressing the current state of knowledge for advanced fuels, cladding, and coolants. Students will gain relevant knowledge to address advanced materials questions in the next generation of nuclear reactors. Systems of interest include high-temperature gas reactors, sodium-cooled fast reactors, molten salt reactors, small modular reactors, research reactors, and more.

### Structure

The majority of this course is **synchronous**, delivered through real-time, face-to-face class sessions. Additional materials and activities are delivered through **Moodle**, a secure and easy-to-use online learning platform. Modifications will be made to allow for asynchronous delivery if required.

### Prerequisites/Corequisites

NE 509

## Learning Outcomes

Upon completion of this course, students will be able to:

1. Identify key phenomena affecting the performance of advanced reactor materials
2. Understand the different stages of microstructural evolution in advanced reactor materials
3. Understand the role of reactor environment on material selection
4. Identify key areas delineating light water reactor and advanced reactor material evolution

## Course Materials

### Required textbook

None

### Optional materials

Comprehensive Nuclear Materials, R. Konings

Light Water Reactor Materials, Vol. 1 Fundamentals, D. Olander and A. Motta

Fundamentals of Radiation Materials Science, G. Was

An Introduction to Nuclear Materials, K. Murty and I. Charit

## Communication Guidelines

### Respecting our learning community

The [NC State Code of Student Conduct](https://policies.ncsu.edu/policy/pol-11-35-01/) outlines expectations for behavior in the classroom (whether virtual or physical) and the consequences for students who violate these expectations. Any behavior that impacts other students’ ability to learn and succeed will be addressed, but expressing diverse viewpoints and interpretations of course content is welcome.

Community guidelines for this course include:

* Use a respectful tone in all forms of communication (email, written, oral, visual)
* Maintain professionalism (avoid slang, poor grammar, etc.) in your written communication.
* Respect regional dialects and culturally embedded ways of oral communication.
* Stay home or in your dorm room if you are exhibiting symptoms of a contagious illness (fever, chills, etc.).
* Enter our virtual and/or physical classroom community respectfully by refraining from lewd or indecent speech or behavior, helping to maintain a safe physical environment, not using your cell phone for voice or text communication except when explicitly given leave to do so, and not attending class under the influence of any substance.
* Treat each community member with respect by not recording others without their consent or engaging in any form of hazing, harassment, intimidation, or abuse.
* Respect cultural differences that may influence communication styles and needs.

## Grading and Feedback

### Grading criteria, details, and timing of feedback

|  |  |  |
| --- | --- | --- |
| **Percentage of grade** | **Component** | **Details and timing of feedback** |
| 80 % | Exams | * There will be four exams throughout the course. Each exam will represent 20% of your grade. * *You will receive a grade within 2 weeks of the exam.\** |
| 20 % | Project | * A topic related to advanced reactor materials will be assigned and the student will present a presentation summarizing the topic area. Students will be evaluated on the technical content and the presentation/organization of the content. * *You will receive a grade/feedback within 2 weeks of submitting your project.\** |

\*modifications to the timing of grades/feedback, if required, will be announced via email.

### Grading scale

This course uses this grading scale:

|  |  |  |
| --- | --- | --- |
| **Low** | **Letter** | **High** |
| 97 ≤ | A+ | ≤ 100 |
| 93 ≤ | A | < 97 |
| 90 ≤ | A- | < 93 |
| 87 ≤ | B+ | < 90 |
| 83 ≤ | B | < 87 |
| 80 ≤ | B- | < 83 |
| 77 ≤ | C+ | < 80 |
| 73 ≤ | C | < 77 |
| 70 ≤ | C- | < 73 |
| 67 ≤ | D+ | < 70 |
| 63 ≤ | D | < 67 |
| 60 ≤ | D- | < 63 |
| 0 ≤ | F | < 60 |

### Requirements for earning a grade of “Satisfactory”

If you are taking this course for credit only (S/U), your grade will be reported as S (Satisfactory) when coursework is equivalent to a C- or better or U (Unsatisfactory) when coursework is equivalent to less than a C-. For more information, see the [Credit Only Courses regulation](https://policies.ncsu.edu/regulation/reg-02-20-15/).

Requirements and procedures for auditing this course

Auditing this course is approved on a case-by-case basis. Please contact the course instructor to attain approval. Refer to the [Audit regulation](https://policies.ncsu.edu/regulation/reg-02-20-04/) for more information and links to required forms.

## Course Schedule

Please note: the course schedule is subject to change.

|  |  |  |  |
| --- | --- | --- | --- |
| **Section** | **Weeks** | **Topic** | **Activities** |
| Intro | 1 | Course Introduction | Introduce yourself in Moodle |
| Module 1 | 3 | HTGRs | Exam 1 |
| Module 2 | 3 | SFRs | Exam 2 |
| Module 3 | 3 | Molten Salts and Ceramics | Exam 3 |
| Module 4 | 3 | Cladding and Research Reactors | Exam 4 |
| Presentation | 1 | Various | Project Presentation |

## Course Policies

### Late assignments

Late assignments will not be accepted.

### Incomplete grades, withdrawals

Information on incomplete grades can be found at [REG 02.50.03 – Grades and Grade Point Average](https://policies.ncsu.edu/regulation/reg-02-50-03/). If you encounter a serious disruption to your work not caused by you and you would have otherwise successfully completed the course, contact your instructor as soon as you can to discuss the possibility of earning an incomplete in the course for the semester, including an agreement on when the remaining work must be done in order to change the grade to the appropriate letter grade.

If your student must withdraw from a course or from the University due to hardship beyond their control, see [Withdrawal Process and Timeline | Student Services Center](https://studentservices.ncsu.edu/your-classes/withdrawal/process/) for information and instructions.

### Attendance

Refer to the NC State Attendance Policy: [REG 02.20.03 – Attendance Regulations](https://policies.ncsu.edu/regulation/reg-02-20-03-attendance-regulations/)

## University Policies

### Academic integrity and honesty

Students are required to comply with the university policy on academic integrity found in the [Code of Student Conduct 11.35.01 sections 8 and 9](http://policies.ncsu.edu/policy/pol-11-35-01). Therefore, students are required to uphold the Pack Pledge: “I have neither given nor received unauthorized aid on this test or assignment.” Violations of academic integrity will be handled in accordance with the [Student Discipline Procedures](https://policies.ncsu.edu/regulation/reg-11-35-02/).

Please refer to the [Academic Integrity](https://studentconduct.dasa.ncsu.edu/academic-integrity-overview/) web page for a detailed explanation of the University’s policies on academic integrity and some of the common understandings related to those policies.

### Student privacy

#### Class recording statement:

* In-class sessions are recorded in such a way that might also record students in this course. These recordings will NOT be used beyond the current semester or in any other setting outside of the course.

### Other Policies

Students are responsible for reviewing the NC State University PRR’s which pertain to their course rights and responsibilities:

* [Equal Opportunity and Non-Discrimination Policy Statement](https://policies.ncsu.edu/policy/pol-04-25-05) and [additional references](https://oied.ncsu.edu/equity/policies)
* [Code of Student Conduct](https://policies.ncsu.edu/policy/pol-11-35-01)
* [Grades and Grade Point Average](https://policies.ncsu.edu/regulation/reg-02-50-03)
* [Credit-Only Courses](https://policies.ncsu.edu/regulation/reg-02-20-15)
* [Audits](https://policies.ncsu.edu/regulation/reg-02-20-04)

## Student Resources

Academic and Student Affairs maintains a website with links for student support on campus, including academic support, community support, health and wellness, financial hardship or insecurity, and more. [Find Help on Campus.](https://dasa.ncsu.edu/support-and-advocacy/find-help/)

### Disability resources

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the [Disability Resource Office (DRO)](https://dro.dasa.ncsu.edu/). For more information on NC State’s policy on working with students with disabilities, please see the [Policies, Rules and Regulations page maintained by the DRO](https://dro.dasa.ncsu.edu/about-us/policies-rules-regulations/) and [REG 02.20.01 Academic Accommodations for Students with Disabilities](https://policies.ncsu.edu/regulation/reg-02-20-01/).

### Safe at NC State

At NC State, we take the health and safety of students, faculty and staff seriously. The [Office for Institutional Equity and Diversity](https://diversity.ncsu.edu/) supports the university community by providing services and resources to support and guide individuals in obtaining the help they need. See the [Safe at NC State webpage](https://diversity.ncsu.edu/safe/) for resources.

### Supporting Fellow Students in Distress

As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remain a healthy and safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you, either for the classmate’s well-being or yours. If you feel this way, I would encourage you to report this behavior to the [NC State CARES website](https://prevention.dasa.ncsu.edu/nc-state-cares/about/). Although you can report anonymously, it is preferred that you share your contact information so they can follow up with you personally.

## Course Evaluations

ClassEval is the end-of-semester survey for students to evaluate the instruction of all university classes. The current survey is administered online and includes 12 closed-ended questions and 3 open-ended questions. Deans, department heads, and instructors may add a limited number of their own questions to these 15 common-core questions.

Each semester students’ responses are compiled into a ClassEval report for every instructor and class. Instructors use the evaluations to improve instruction and include them in their promotion and tenure dossiers, while department heads use them in annual reviews. The reports are included in instructors’ personnel files and are considered confidential.

Online class evaluations will be available for students to complete during the last two weeks of the semester for full-semester courses and the last week of shorter sessions. Students will receive an email directing them to a website to complete class evaluations. These become unavailable at 8 am on the first day of finals.

* Contact ClassEval Help Desk: [classeval@ncsu.edu](mailto:classeval@ncsu.edu)
* [ClassEval website](http://go.ncsu.edu/cesurvey)
* [More information about ClassEval](http://oirp.ncsu.edu/surveys/classeval)

## Syllabus Modification Statement

Our syllabus represents a flexible agreement. It outlines the topics we will cover and the order in which we will cover them. Dates for assignments represent the earliest possible time they would be due. The pace of the class depends on student mastery and interests. Thus, minor changes in the syllabus can occur if we need to slow down or speed up the pace of instruction.