

NE 407 Nuclear Thermal-Hydraulics Laboratory

Fall 2026, 2 Credit Hours

1 Course Information

- **Schedule**

- *Time:* Mondays, 08:30 am - 09:20 am
- *Lecture location:* Room 216, 111 Lampe Drive
- *Laboratory location:* See Table 1
- *Course website:* **Moodle** will be used to post lecture slides, assignments, exams and other materials.
<https://moodle-courses2527.wolfware.ncsu.edu/course/view.php?id=10703&bp=s>
- *Lecture recordings:* **Panopto** will be used to host the lecture recordings.
<https://ncsu.hosted.panopto.com/Panopto/Pages/Sessions/List.aspx#folderID=324a6c9e-148b-4bca-bfa2-b4a301620ea3>

- **Instructor:**

- *Course Instructor:* Dr. Xu Wu, Associate Professor of Nuclear Engineering
- *Office:* Burlington Laboratory 2110
- *Office Hour:* Mondays, 10:00 am - noon, in-person. Time is flexible by Zoom (by appointment).
- *Phone:* 919-515-6570
- *Email:* xwu27@ncsu.edu
- *Website:* <https://www.ne.ncsu.edu/people/xwu27>

- **Teaching Assistant:**

- *TA 1:* Arian Timm
- *Email:* artimm2@ncsu.edu
- *Office Hours:* Tuesdays, 2:00 pm - 4:00 pm, BU 2149
- *TA 2:* Noah Etter
- *Email:* naetter@ncsu.edu
- *Office Hours:* Tuesdays, 11:00 am - 1:00 pm, BU 3332
- *TA 3:* Briana Laramée
- *Email:* bklarame@ncsu.edu
- *Office Hours:* Thursdays, 11:00 am - 1:00 pm, BU 2113

- **Course evaluations:**

- Online class evaluations will be available for students to complete during the last 2 weeks of the semester. It will become unavailable at 8am on the first day of finals.

- Students will receive an email directing them to a website where they can login using their Unity ID and complete evaluations.
- All evaluations are **confidential**; instructors will **not** know how any one student responded to any question, and students will not know the ratings for any instructors.
- Results of the evaluation is revealed to the instructor **after** the grades are posted.
- The evaluation website will be sent to you when ready.

2 Description and Objectives

- This course is a laboratory course performed in the thermal-hydraulics laboratory and utilizing the PULSTAR reactor. This course will provide students with laboratory practice on various fluid flow and heat transfer phenomena seen in nuclear reactor systems and design.
- This course will cover topics including propagation of errors, heat balance on the PULSTAR reactor, heat conduction, forced heat convection, condensation, flow regime mapping, critical heat flux, friction and form losses, and natural circulation on the PULSTAR reactor.
- Upon completion of this course, students will be able to:
 1. Apply principles of fluid mechanics and heat transfer to laboratory experiments.
 2. Create professional reports based on experimental-based fluid flow and heat transfer phenomena analysis.
 3. Demonstrate the ability to work effectively in engineering teams.

3 Prerequisites

- NE 400/500 - Nuclear Reactor Energy Conversion (Prerequisite for NE 402/502)
 - Introduction to the concepts and principles of heat generation and removal in reactor systems. Power cycles, reactor heat sources, analytic and numerical solutions to conduction problems in reactor components and fuel elements, heat transfer in reactor fuel bundles and heat exchangers.
- NE 402/502 - Reactor Engineering
 - A course in thermal-hydraulic design and analysis of nuclear systems. Single and two-phase flow, boiling heat transfer, modeling of fluid systems. Design constraints imposed by thermal-hydraulic considerations are discussed.

4 Outline of Topics

- 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.
- Learning activities will include discussion forums, individual laboratory reports, and exams.
- This course consists of **nine lecture + laboratory modules**, as shown in Table 1.

Table 1: List of lab modules ([†]projects that need not only a **Data Analysis Report** but also a **Final Report**)

Lab modules	Lab module titles	Duration (weeks)	Locations
1	Propagation of Errors (project only, no lab)	1.0	N/A
2	Heat Balance on the PULSTAR	1.5	PULSTAR
3	Heat Conduction [†]	1.5	BU 3148
4	Friction and Form Losses	2.5	BU 3148
5	Heat Convection [†]	2.5	BU 3148
6	Condensation	1.5	BU 3148
7	Flow Regime Mapping [†]	1.0	High bay area
8	Critical Heat Flux	1.5	BU 3148
9	Natural Circulation on the PULSTAR	1.5	PULSTAR

5 Course Schedule

- Detailed course schedule will be available in a separate document, including deadlines for each lab, lab assignment, quizzes, etc.
- The **lecture time** is expected to be 50 minutes every week.
- The **laboratory time** is expected to be 1 hour 50 minutes per lab for lab modules 2-9.
- The time slots for the **seven lab groups/sessions** can be found in Table 2.

Table 2: List of time slots for the seven lab sessions.

Groups	Number of students	Days	Time slots
NE 407-001	5	Wednesday	08:30 am - 10:20 am
NE 407-002	6	Monday	12:50 pm - 14:40 pm
NE 407-003	5	Wednesday	15:00 pm - 16:50 pm
NE 407-004	7	Wednesday	12:50 pm - 14:40 pm
NE 407-005	6	Friday	08:30 am - 10:20 am
NE 407-006	7	Friday	10:40 am - 12:30 pm
NE 407-007	6	Friday	12:50 pm - 14:40 pm

- Please note that as Fall 2026 is the first time NE 407 is offered, the course schedule is subject to

change. The schedule will be updated regularly based on the course progress and student needs and will be posted on Moodle.

6 Assignments and Grading Policy

- (1) See Table 3 for the grading criteria, assignment details, and timing of feedback. Modifications to the timing of grades/feedback, if required, will be announced via email.

Table 3: Grading criteria, details, and timing of feedback

Components	Weights	Details and timing of feedback
Pre-lab homework	16%	- Individual short questions before labs 2-9. - The weight is 2% for each lab module. - The pre-lab homeworks will be posted in Moodle on the Wednesday before the lab. - You will receive a grade/feedback within one week of submission.
Laboratory assignments	60%	- Individual assignments that go along with each laboratory (course contains 9 Data Analysis Reports and 3 Final Reports). - Grading criteria are included within each laboratory to cover only a Data Analysis Report or both Data Analysis and Final Reports. - Each report is worth 5% of the total grade. Non-attendance is penalized at 50% for each report for the specific laboratory missed. - You will receive a grade/feedback within one week of submission.
Quizzes	24%	- There will be two quizzes covering fundamental questions related to nuclear thermal hydraulics and covered in the laboratory handouts/lectures. - The quizzes are in-class on Mondays (50 minutes), close book, close notes. - The times can be found in the Schedule. - You will receive a grade within two weeks after the quizzes.

- (2) There is **no final exam** in the University Final Exams Week.

(3) Grading

- The course will be graded on the letter grading scale listed in Table 4 and will count toward your GPA. More information can be found at <https://studentservices.ncsu.edu/your-grades/general-info/>.

- *Requirements for Credit-Only (S/U) Grading:* In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to <http://policies.ncsu.edu/regulation/reg-02-20-15>.
- *Requirements for Auditors (AU):* Information about and requirements for auditing a course can be found at <http://policies.ncsu.edu/regulation/reg-02-20-04>.
- *Policies on Incomplete Grades:* If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at <http://policies.ncsu.edu/regulation/reg-02-50-3>.

Table 4: Letter grades.

Low	Grade	High
$97 \leq$	A+	≤ 100
$93 \leq$	A	< 97
$90 \leq$	A-	< 93
$87 \leq$	B+	< 90
$83 \leq$	B	< 87
$80 \leq$	B-	< 83
$77 \leq$	C+	< 80
$73 \leq$	C	< 77
$70 \leq$	C-	< 73
$67 \leq$	D+	< 70
$63 \leq$	D	< 67
$60 \leq$	D-	< 63
$0 \leq$	F	< 60

7 Texts and Materials

- **Recommended Textbook:** Todreas, N. E., & Kazimi, M. S. (2021). Nuclear systems volume I: Thermal hydraulic fundamentals. Third Edition. CRC press.
- A digital copy of the textbook is available for student use at <https://catalog.lib.ncsu.edu/catalog/NCSU4826761>.
- NCSU library has hardcover copies at <https://catalog.lib.ncsu.edu/catalog/NCSU5292745>
- **Other materials:** Handouts and additional supporting materials will be provided for each laboratory session.

8 Others

(1) Late Assignments Policy

- Unless stated otherwise, assignments are due by the end of day on the designated due date. Assignments turned in within 24 hours of this time are considered late and will be assessed a 25% penalty. Assignments turned in after 24 hours will be marked and returned to the student, but no credit will be assigned.
- To allow for unforeseen circumstances, each student will be granted a **one-time exemption**. The student should contact the course instructor **at least three days** before the original deadline and explain the situation in order to get an extension. The assignment must be turned in by the end of the new designated due date.

(2) Course Attendance/Absence Policy

- Active class participation is strongly encouraged.
- **Students are required to attend all assigned laboratories. Non-attendance is penalized at 50% for each report for the specific laboratory missed.**
 - If you cannot attend a particular time slot assigned to your group - please notify the instructor and TA in advance to attend the laboratory with another group.
- NC State attendance policies can be found at: REG 02.20.03 - Attendance Regulations - Policies, Regulations & Rules (<https://policies.ncsu.edu/regulation/reg-02-20-03-a-ttendance-regulations/>). Please refer to the course's attendance, absence, and deadline policies for additional details.
- *Absences Policy*: Personal Problems: We understand that sometimes life makes it difficult to focus on schoolwork. If you are having a personal problem that affects your participation in this course, please talk to us to create a plan. Please do not wait until the end of the semester to share any challenges that have negatively impacted your engagement and academic performance. The sooner we connect, the more options we will have available to us to support your overall academic success. If you are not comfortable speaking with us directly, please utilize the other student resources provided below in order to understand how to best approach success in this course given your personal needs as soon as possible.

(3) 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.

(4) Transportation

- This course will not require students to provide their own transportation. Non-scheduled class time for field trips or out-of-class activities is NOT required for this class.

(5) Safety & Risk Assumptions

- N/A

(6) Academic Integrity

- Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at <https://policies.ncsu.edu/policy/pol-11-35-01/>
- Absolutely no collaboration is permitted during closed-book tests. All the tests are closed book unless otherwise specified.
- Collaboration on homework assignments is allowed, but the submitted work must be your own individual work. Homework assignments must not be treated as group assignments. Zero grade will be assigned for particular homework for the first offense. Second offense will be reported to the Office of Student Conduct.
- Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02) at <https://policies.ncsu.edu/regulation/reg-11-35-02/>. 11.35.02)

(7) Additional NC State Rules and Regulations

- Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:
 - Equal Opportunity and Non-Discrimination Policy Statement <https://policies.ncsu.edu/policy/pol-04-25-05/> with additional references at <https://oied.ncsu.edu/divweb/policies/>.
 - Code of Student Conduct Policy <https://policies.ncsu.edu/policy/pol-11-35-01/>

(8) Use of Electronic Devices in Class

- Cell phones are to be turned OFF prior to entering the classroom/lab. No exceptions.
- Use of laptops/other electronic devices during class is permitted only for the purpose of following the posted lecture materials/taking electronic notes.

(9) Accommodations for Students with Disabilities

- Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653.
- For more information on NC State's policy on working with students with disabilities, please see the "REG 02.20.01 - Academic Accommodations for Students with Disabilities" at <https://policies.ncsu.edu/regulation/reg-02-20-01/>.

(10) Non-Discrimination Policy

- NC State provides equal opportunity and affirmative action efforts, and prohibits all forms of unlawful discrimination, harassment, and retaliation ("Prohibited Conduct") that are based upon a person's race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability, gender identity, genetic information, sexual orientation, or veteran status (individually and collectively, "Protected Status").

- Additional information as to each Protected Status is included in NCSU REG 04.25.02 (Discrimination, Harassment and Retaliation Complaint Procedure). NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or <https://oied.ncsu.edu/divweb/>.
- Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

(11) Student Mental Health

- As a student you may experience a range of personal issues that can impede learning, such as strained relationships, increased anxiety, alcohol/drug concerns, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may impact your ability to participate in daily activities. It is very important that you have a support system and that you ask for help when you are struggling. The Counseling Center at NC State offers confidential mental health services for full time NC State students, including same-day emergency services. Please visit <https://counseling.dasa.ncsu.edu/> to get connected.