CE 594: Nondestructive Evaluation of Concrete

Instructor:
Mohammad Pour-Ghaz
Office: MN 431C,
Tel: 919-515-2235 (please note that I may not be in office and may be working from home)
Email: mpourghaz@ncsu.edu (best way to contact me)
Office hours: By appointment via Zoom
Web address: Moodle

Class Session:
Spring Semester, 3 Credit hours
Tuesday and Thursday, 10:15 AM – 11:30 AM
111 Lampe Drive (Daniels Hall) Room 331

Pre- and Co-requisites:
CE 225: Mechanics of Solids

Student Learning Outcome:
By the end of this course, students should be able to:

• Explain the principles of operation of different nondestructive test methods
• Explain advantages and limitations of different nondestructive test methods
• Describe different factors that may influence the measurements
• Interpret the measurement data from different test methods

References:
Textbook(s): None

Other References and Resources:
Journal paper will be introduced throughout the semester in class as reference materials and reading assignment. Students need access to MATLAB for this course.

Communications Policy
• I generally check email regularly so this will be the best way to reach the me most of the time.
• I will use Moodle to post content relevant to the class. I will try to announce important new postings in class or by email, but you should check Moodle regularly to be sure.
• I will occasionally send emails to the class and will send them to the email address in the Moodle portal, check this email regularly.
CE 594: Nondestructive Evaluation of Concrete

Description:
This course covers the fundamentals, measurement techniques, and data interpretation of a wide range of nondestructive test methods that are commonly used to evaluate the performance of concrete and reinforced concrete materials and structures. This course covers both laboratory and field test methods including: visual inspection methods, surface harness methods, penetration resistance techniques, pullout tests, maturity methods, absorption and permeability test methods, resonant frequency methods, stress wave propagation based methods (ultrasonic pulse velocity, impact based methods, acoustic emission, etc.), electrically based methods (surface and bulk resistivity and electrical impedance spectroscopy), electrochemical and corrosion measurement methods, and electromagnetic methods. Students will also be introduced to more advanced subjects such as nonlinear acoustics, nonlinear ultrasonic, and electrical impedance tomography.

Course Structure:
This course is delivered as lectures. Lecture notes will be provided. Homework and reading assignments will be assigned every two to three lectures. This course will include a midterm and a final exam.

Homework:
Homework assignments will be posted as Word or PDF documents on the course Moodle site. Late homework will not be accepted unless there are circumstances out of control of the students. Detailed solutions to the homework assignments will be posted on the course Moodle site after the due date. Assignments should be submitted directly to the instructor by email. Instructions may be unique to each assignments and will be provided.

Exams
Two take-home test be given. This course does NOT have a Final Exam at the schedule time by the University. The second test will be given on the last day of class. There is no cumulative final. You will be permitted to use your notes during the exam. Exams must be completed individually. Make-up exams will only be granted in extraordinary circumstances and should, if possible, be requested well in advance of the test. Exams should be submitted directly to the instructor by email.

Course Schedule:
The course schedule is subjected to change with appropriate notification to students.

Projected schedule of readings, assignments, quizzes, and tests:
- Reading materials will be assigned each lecture, mainly consisting of the lecture notes (PDF of slides).
- Homework assignments will be assigned approximately every two to three lectures. Depending on the level of difficulty, the homework will be due 7 to 14 days after the assignment date.
- Several research articles will be assigned as reading assignments.
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Grading:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>97-100</td>
<td>A+</td>
<td>93-96.9 A</td>
</tr>
<tr>
<td>87-89.9</td>
<td>B+</td>
<td>83-86.9 B</td>
</tr>
<tr>
<td>77-79.9</td>
<td>C+</td>
<td>73-76.9 C</td>
</tr>
<tr>
<td>67-69.9</td>
<td>D+</td>
<td>63.66.9 D</td>
</tr>
<tr>
<td>&lt;60</td>
<td>F</td>
<td></td>
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</tbody>
</table>

Addition of Grading:

- Homework: 25%
- Test 1 (Take-home): 35%
- Final Exam (Take-home): 40%

Absence and Make-Up Policies

Students are responsible for all material covered in class. In general, if a student misses classes, she/he should not expect to do well in this course. However, certain situations arise that may require an absence. In these cases, I request that before coming to the instructor for clarification of missed content that you make every effort to obtain and review the missed notes and lecture materials on Moodle and watch videos online; recordings of the lectures will be available to on-campus and EOL students. Additional details specific to the pandemic are provided later in the syllabus.

Students who expect to miss class due to officially recognized events (see Attendance Regulation (REG02.20.03): http://policies.ncsu.edu/regulation/reg-02-20-03) should inform the instructor as far in advance of the absence as possible and provide any required documentation. Alternative arrangements will generally be made for any examinations and other graded in-class work affected by such absences.

The University attendance regulation (NCSU REG 02.20.3) can be found at: http://policies.ncsu.edu/regulation/reg-02-20-03

Academic Integrity:

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at http://policies.ncsu.edu/policy/pol-11-35-01.

Accommodations for Disabilities:

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office (http://www.ncsu.edu/dso), 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at http://policies.ncsu.edu/regulation/reg-02-20-01.
NC State University Polices, Regulations, and Rules (PRRs):
Students are responsible for reviewing the PRRs which pertain to their course rights and responsibilities. These include: http://policies.ncsu.edu/policy/pol-04-25-05 (Equal Opportunity and Non-Discrimination Policy Statement), http://oied.ncsu.edu/oied/policies.php (Office for Institutional Equity and Diversity), http://policies.ncsu.edu/policy/pol-11-35-01 (Code of Student Conduct), and http://policies.ncsu.edu/regulation/reg-02-50-03 (Grades and Grade Point Average).

Course Evaluation:
Class evaluations will be available for students to complete during the last two weeks of classes. All evaluations are confidential and instructors will never know how any one student responded to any question. Also, students will never know the ratings for any particular instructors.

Evaluation website: https://classeval.ncsu.edu
Student help desk: classeval@ncsu.edu
More information: http://www.acs.ncsu.edu/UPA/classeval/

For further information please contact:
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Policy on Incomplete Grades
If extenuating circumstances arise for a student, the instructor may permit the student to receive an incomplete grade. In this case, the instructor and student will discuss the particular tasks needed, the time given, and the grade that will result if those are successfully completed. 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-02-50-03

Non-Discrimination Policy
NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. 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 http://www.ncsu.edu/equal_op/. 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.
CORONAVIRUS INFORMATION
Due to the Coronavirus pandemic, public health measures have been implemented across campus. Students should stay current with these practices and expectations through the Protect the Pack website (https://www.ncsu.edu/coronavirus/). The sections below provide expectations and conduct related to COVID-19 issues.

Health and Participation in Class
- We are most concerned about your health and the health of your classmates and instructors/TAs.
- If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, please work with your instructor on health accommodations and follow other university guidelines, including self reporting: https://healthypack.dasa.ncsu.edu/coronavirus/. Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus.
- If you feel unwell, even if you have not been knowingly exposed to COVID-19, please do not come to class.
- If you are in quarantine, have been notified that you may have been exposed to COVID-19, or have a personal or family situation related to COVID-19 that prevents you from attending this course in person (or synchronously), please connect with your instructor to discuss the situation and make alternative plans, as necessary.
- If you need to make a request for an academic consideration related to COVID-19, such as a discussion about possible options for remote learning, please talk with your instructor for the appropriate process to make a COVID-19 request.

Health and Well-Being Resources
These are difficult times, and academic and personal stress is a natural result. Everyone is encouraged to take care of themselves and their peers. If you need additional support, there are many resources on campus to help you:
- Counseling Center (https://counseling.dasa.ncsu.edu/)
- Health Center (https://healthypack.dasa.ncsu.edu/)
- If the personal behavior of a classmate concerns or worries you, either for the classmate’s wellbeing or yours, we encourage you to report this behavior to the NC State CARES team: (https://advising.dasa.ncsu.edu/resources-for-advisors/advisors-toolkit/cares/)
- If you or someone you know are experiencing food, housing or financial insecurity, please see the Pack Essentials Program (https://dasa.ncsu.edu/pack-essentials/).

Community Standards related to COVID-19
We are all responsible for protecting ourselves and our community. Please see the community expectations (link TBD) and Rule 04.21.01 regarding Personal Safety Requirements Related to COVID-19 https://policies.ncsu.edu/rule/rul-04-21-01/
Course Expectations Related to COVID-19:
- Personal Protective Equipment: As a member of the NC State academic community you are required to follow all university guidelines for personal safety with face coverings, physical distancing, and sanitation. Face coverings are required in this class and in all NC State buildings. Face coverings should be worn to cover the nose and mouth and be close fitting to the face with minimal gaps on the sides. In addition, students are responsible for keeping their course/work area clean.
- Course Attendance: NC State attendance policies can be found at: https://policies.ncsu.edu/regulation/reg-02-20-03-attendance-regulations. Please refer to this course’s attendance, absence, and deadline policies for additional details. If you are quarantined or otherwise need to miss class because you have been advised that you may have been exposed to COVID-19, you should not be penalized regarding attendance or class participation. However, you will be expected to develop a plan to keep up with your coursework during any such absences. If you become ill with COVID-19, you should follow the steps outlined in the health and participating section above. COVID-19-related absences will be considered excused; documentation need only involve communication with your instructor.
- Course Meeting Schedule: Your course might not have a traditional meeting schedule in Fall 2020. Be sure to pay attention to any updates to the course schedule as the information in this syllabus may have changed. Please discuss any questions you have with the instructor.
- Classroom Seating: To support efficient, effective contact tracing, please sit in the same seat when possible and take note of who is sitting around you; instructors may also assign seats for this purpose.
- Technology Requirements: This course may require particular technologies to complete coursework. Be sure to review the syllabus for these expectations, and see go.ncsu.edu/syllabustech-requirements to find out more about technical requirements for your course. If you need access to additional technological support, please contact the Libraries’ Technology Lending Service: https://www.lib.ncsu.edu/devices.

Course Delivery Changes Related to COVID-19
Please be aware that the situation regarding COVID-19 is frequently changing, and the delivery mode of this course may need to change accordingly, including from in-person to online. Regardless of the delivery method, we will strive to provide a high-quality learning experience.

Grading/Scheduling Changing Options Related to COVID-19
If the delivery mode has a negative impact on your academic performance in this course, the university has provided tools to potentially reduce the impact:
- Late Drop: https://studentservices.ncsu.edu/your-resources/covid-19/spring2020-latedrop/. In some cases, another option may be to request an incomplete in the course. Before using any of these tools, discuss the options with your instructor and your academic advisor. Be aware that if you use the enhanced S/U, you will still need to complete the course and receive at least a C- to pass the course.