MME 4331 / 5351 / 6351 (CRNs 26766, 26934, 26935) - Nondestructive Evaluation
Course Syllabus
Spring 2024

INSTRUCTOR:
Mr. Paul R. Spencer, P.E.
prspencer@utep.edu)
Office Hours (in person, after class): 17:50 to 18:30 Tuesdays and Thursdays

COURSE DESCRIPTION: Nondestructive evaluation (NDE) tools can help the forensic analyst characterize discontinuities that may be present in materials and components, and relate their presence to a potential role in a failure. The course will start by exploring NDE reliability concepts, considerations for method selection, origins of discontinuities in materials, and comparing nondestructive and destructive tests. An extensive summary of reference materials will prove useful to students who wish to pursue NDE certifications in the course of their career. Discussion of methods frequently encountered in industry will include underlying physical principles, relative merits, test procedures, calibrations, detectability of various types of discontinuities, interpretation of test results, artifacts and nonrelevant indications, quality assurance and safety considerations, and demonstration and/or hands-on experience (when feasible). NDE methods often associated with flaw detection include liquid penetrant, magnetic particle, radiographic, ultrasonic, and eddy current. Specialized test methods, such as acoustic emission, thermography, shearography and x-ray fluorescence spectroscopy will also be addressed.

PRE-REQUISITES: MME2303 (w/C or better) and junior or senior standing.

COURSE STRUCTURE: This is a hands-on course that includes lecture and laboratory components. Weekly dual lecture modules are expected to take up to 3 hours and will primarily be delivered in person, interspersed with laboratory sessions expected to take up to 1.5 hours. The lectures describe the physical principles, test techniques, and interpretation issues associated with the nondestructive test methods frequently employed by forensic analysts and utilized in the hands-on component of the course. Up to three laboratory sessions will substitute for lectures; there is no separate laboratory course.

Lecture Instructions: One module is assigned each week. Each module includes the following:
- two lecture/reading assignments (80 minutes each), primarily presented in person, on campus. On those weeks when a hands-on laboratory session is scheduled one of the lecture sessions will be replaced with the scheduled laboratory session.
- a comprehension quiz (10 minutes) - administered at the conclusion of the series of lectures comprising each major topic.

Laboratory Instructions: One laboratory session is assigned for each of three selected test methods. Laboratory sessions include the following:
- brief demonstrations and safety discussions (15 - 20 minutes)
- laboratory group sessions (1 hour)
- individually-authored lab reports associated with the hands on laboratory group sessions (1 hour) - due as assigned.

The course is divided into four subsections:
- Part I: Introduction - Illustrate NDE applications outside the domain of forensic investigations, compare and contrast relative merits of destructive and nondestructive tests, explain concepts of probability of detection, identify critical selection criteria for common NDE methods.
- Part II: Surface Specific Test Methods - Convey the theory and physical principles associated with liquid penetrant and magnetic particle testing. Use these NDE methods to detect and identify discontinuities in engineering materials.
- Part III: Volumetric Test Methods: Explore the theory and physical principles associated with radiographic and ultrasonic testing. Use ultrasonic test techniques to detect and identify discontinuities in engineering materials.
- Part IV: Student Presentations of Specialized NDE Methods

COURSE RESOURCES
- Provided by department: Course slidedecks and videos provided on Blackboard
- Textbook: OPTIONAL, available online via UTEP Library, no cost to students.

; Handbook of Nondestructive Evaluation, 3E

Hellier, Chuck, author.

2020

Available Online Options

COURSE LEARNING OUTCOMES:

- Solve problems using the theory and physical principles of frequently used NDE methods
  - Evaluated via quizzes, examinations and laboratory reports.
- Identify the multiple bases of uncertainty in examination results.
  - Evaluated via discussion board contributions.
- Compare the relative merits of common NDE methods and techniques to facilitate selection and implementation in future inspection scenarios.
  - Evaluated via quizzes and examinations.
- Apply examination results to discontinuity characterization in the context of forensic investigations.
  - Evaluated via quizzes and examinations.

STUDENT OUTCOMES:

- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

COURSE TOPICS:

- Introduction
  - Comparison of destructive and nondestructive tests
  - Test reliability - probability of detection and interpretation issues
  - Test method selection
  - Inspector credentials
- Liquid Penetrant - with laboratory exercise
- Magnetic Particle - with laboratory exercise
- Radiography
  - Conventional film and digital imaging
  - Specialized techniques (neutron, flash)
- Ultrasonic Testing - with laboratory exercise
  - Thickness measurements
  - Shear wave
  - Phased array
- Chemical Analysis using X-Ray Fluorescence - with laboratory exercise
- Student Presentations of Specialized NDE Methods

COURSE GRADING:

Lecture Comprehension Quizzes	15%
Lab Reports	10%
1st exam	20%
2nd exam	20%
Student Presentation	10%
Comprehensive Final Exam	25%

Laboratory reports for this course are assessed according to a grading rubric (Attachment A). No late work will be accepted.

COURSE DROP POLICY: Students who fail to turn in 5 assignments (quizzes and lab reports) will be dropped from the course. The student withdrawal deadline with a 'W' is October 28th. After October 28th, students may drop the course, and will receive a grade of W or F. To drop this class, please contact the Registrar's Office to initiate the drop process. If you cannot complete this course for whatever reason, please contact me. If you do not, you are at risk of receiving an "F" for the course.

TECHNOLOGY REQUIREMENTS:
Course content is primarily delivered in person on campus, however occasional lectures and supplemental video content will be presented via the Internet through the Blackboard learning management system (LMS). Ensure your UTEP e-mail account is working and that you have access to the Web and a stable web browser. Mozilla Firefox and Google Chrome are the most supported browsers for Blackboard; other browsers may cause complications with the LMS. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

You will need to have or have access to a computer/laptop, scanner, a webcam, and a microphone. You will need to download or update the following basic software: Microsoft Office, Adobe, Flashplayer, Windows Media Player, QuickTime, and Java. Check that your computer hardware and software are up-to-date and able to access all parts of the course.

If you encounter technical difficulties beyond your scope of troubleshooting, please contact the Help Desk as they are trained specifically in assisting with technological needs of students.

NETIQUETTE

- Always consider your audience. Remember that members of the class and the instructor will be reading any postings.
- Respect and courtesy must be provided to classmates and to instructor at all times. No harassment or inappropriate postings will be tolerated.
- When reacting to someone else's message, address the ideas, not the person. Post only what anyone would comfortably state in a F2F situation.
- Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only. Please do not copy documents and paste them to a publicly accessible website, blog, or other space. If students wish to do so, they have the ethical obligation to first request the permission of the writer(s).

CLASS RECORDINGS
The use of recordings will enable you to have access to class lectures, group discussions, and so on in the event you miss a synchronous or in-person class meeting due to illness or other extenuating circumstance. Our use of such technology is governed by the Federal Educational Rights and Privacy Act (FERPA) and UTEP's acceptable-use policy. A recording of class sessions will be kept and stored by UTEP, in accordance with FERPA and UTEP policies. Your instructor will not share the recordings of your class activities outside of course participants, which include your fellow students, teaching assistants, or graduate assistants, and any guest faculty or community-based learning partners with whom we may engage during a class session. You may not share recordings outside of this course. Doing so may result in disciplinary action. The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course. They may not be further disseminated.

COURSE COMMUNICATION
This is a conventional on-campus, in-the-classroom course. Regardless, I use a variety of communication tools:

- Office Hours: I don't have an office on campus, but I will still have office hours for your questions and comments about the course. My office hours will be held 17:50 to 18:30 Tuesdays and Thursdays after class or via Blackboard.
- Course messaging (internal e-mail) within Blackboard is the best way to contact me. I will make every attempt to respond to your e-mail within 24-48 hours of receipt. When e-mailing me, be sure to email from your UTEP student account and please put the course number in the subject line. In the body of

your e-mail, clearly state your question. At the end of your e-mail, be sure to put your first and last name, and your university identification number.
- Discussion Board: If you have a question that you believe other students may also have, please post it in the Help Board of the discussion boards inside of Blackboard. Please respond to other students' questions if you have a helpful response.
- Announcements: Check the Blackboard announcements frequently for any updates, deadlines, or other important messages.

ACCOMMODATIONS POLICY
The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the UTEP Center for Accommodations and Support Services.

SCHOLASTIC INTEGRITY:
Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) for possible disciplinary action. To learn more HOOP: Student Conduct and Discipline.

COVID-19 PRECAUTION STATEMENT
Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, you are encouraged to report your results to covidaction@utep.edu, so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID-19 testing.

The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area, and will be available at no charge on campus during the first week of classes. For more information about the current rates, testing, and vaccinations, please visit www.epstrong.org.

SUPPLEMENTAL RESOURCES
UTEP provides a variety of student services and support:

Technology Resources
- Help Desk: Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.

Academic Resources
- UTEP Library: Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- University Writing Center (UWC): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- Math Tutoring Center (MaRCS): Ask a tutor for help and explore other available math resources.

- RefWorks: A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.

Individual Resources

- Military Student Success Center: Assists personnel in any branch of service to reach their educational goals.
- Center for Accommodations and Support Services: Assists students with ADA-related accommodations for coursework, housing, and internships.
- Counseling and Psychological Services: Provides a variety of counseling services including individual, couples, and group sessions as well as career and disability assessments.

ATTACHMENT A
MME 4331/5351 MASE 6351
Laboratory Report Grading Rubric

CATEGORY	ABOVE AVERAGE 8 – 10 points	AVERAGE 7 - 3 points	BELOW AVERAGE 2 - 0 points
Cover Page	Includes all required information (Lab session title, student name, course number, UTEP, due date, electronic signature).	N/A	Missing any of the required information.
Objectives	Section heading, includes objectives	Misstates objectives.	Missing objectives.
Introduction	Section heading, includes - thorough description of test item - test method and technique - brief description of test apparatus - what was analyzed	Missing only 1 requirement.	Missing more than 1 requirement.
Background	Section heading, brief description of method and specific technique employed.	Missing 1 or 2 technical or format requirements, and/or needs to improve narrative.	Missing more than 2 requirements, and/or format requirements, and/or needs to improve narrative.
Procedures	Section heading, sequential summary of experimental steps.	Missing 1 or 2 technical or format requirements, and/or needs to improve narrative.	Missing more than 2 requirements, and/or format requirements, and/or needs to improve narrative.
Quality Assurance	Section heading, describe QA measures and associated data.	Missing 1 or 2 technical or format requirements, and/or needs to improve narrative.	Missing more than 2 requirements, and/or format requirements, and/or needs to improve narrative.
Results	Section heading, present and interpret experimental data (e.g., quantity and dimensions of indications, correctly identify associated discontinuities).	Missing 1 or 2 technical or format requirements, and/or needs to improve narrative (poor interpretation).	Missing more than 2 requirements, and/or format requirements, and/or needs to improve narrative (poor interpretation).
Figure and Table Format	Includes figure and table captions, with associated units and citations. Refers to all figures and/or tables within the text.	Missing only 1 requirement	Missing more than 1 requirement.
Conclusions	Section heading, clearly states conclusion(s) deduced from the lab exercise (e.g., summarizes and interprets indications observed).	Missing conclusion(s) or conclusion(s) not supported by test results.	Missing conclusions.
Grammar	Proper capitalization, use of articles, subject-verb agreement, spelling, punctuation	1 or 2 errors.	More than 2 errors.
References	Cite any references used. Instances of plagiarism will be reported to the Office for Student Conduct and Conflict Resolution.		
Extra Credit	Up to 10 points of extra credit may be awarded for applying and expressing your materials engineering knowledge to augment laboratory exercise data interpretation (this "enhanced" content should be added to the Results and/or Conclusions sections).		