

**MME 4331 (CRNs 19499, 19500, 19501) - Nondestructive Evaluation**  
**Course Syllabus**  
**Fall 2020**

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**INSTRUCTOR:**

Mr. Paul R. Spencer

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Office Hours (via Blackboard or Microsoft Teams): 18:00 to 19:00 Mondays and Wednesdays

**COURSE DESCRIPTION:** NDE 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, method selection considerations, 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 and shearography and methods intended for material characterization, such as x-ray fluorescence spectroscopy and in-situ metallographic techniques 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 be delivered synchronously, 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.

**Lecture Instructions:** One module is assigned each week. Each module includes the following:

- two lecture/reading assignments (80 minutes each), presented synchronously via Blackboard Collaborate. 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) - due at the end of the second session each week.
- 1 posting on the discussion board + 2 replies (15 minutes) - due by 11:59 pm on Sunday.

**Laboratory Instructions:** One laboratory session is assigned for each of four 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 by 11:59 pm on the following Sunday

The course is divided into 3 parts:

- 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.

**COURSE RESOURCES**

Provided by department: No textbook; Course notes, PowerPoints and videos provided on Blackboard,

**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
  - Synopsis of specialized NDE methods
- 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
- In-situ Metallography

#### COURSE GRADING:

Lecture		Lab	
Comprehension	25%	Reports	20%
Quizzes			
Discussion Board	15%	Exams	40%
Postings			

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 will be dropped from the course. The student withdrawal deadline with a 'W' is October 30<sup>th</sup>. After October 30<sup>th</sup>, 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 delivered 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

Because portions of this class will be delivered online, we won't see each other in the ways you may be accustomed to: during class time, small group meetings, and office hours. However, there are a number of ways we can keep the communication channels open:

- Office Hours: We may be unable to meet on campus, but I will still have office hours for your questions and comments about the course. My office hours will be held 18:00 to 19:00 Mondays and Wednesdays on Blackboard Collaborate.
- 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 PANDEMIC PRECAUTIONS

You must STAY AT HOME and REPORT if you (1) have been diagnosed with COVID-19, (2) are experiencing COVID-19 symptoms, or (3) have had recent contact with a person who has received a positive coronavirus test. Reports are made at [screening.utep.edu](#). If you know of anyone who should report any of these three criteria, you should encourage them to report. If the individual cannot report, you can report on their behalf by sending an email to [COVIDaction@utep.edu](mailto:COVIDaction@utep.edu).

For each day that you attend campus—for any reason—you must complete the questions on the UTEP screening website ([screening.utep.edu](#)). The website will verify if you are permitted to come to campus. Under no circumstances should anyone come to class when feeling ill or exhibiting any of the known COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, and alternative instruction will be provided. Students are advised to minimize the number of encounters with others to avoid infection.

UTEP requires everyone to wear a mask in common spaces, or where two or more individuals are located, including, but not limited to, classrooms. You must wear a mask covering your nose and mouth at all times in this class. If you choose not to wear a mask, you may not enter the classroom. If you remove your mask, you will be asked to put it on or leave the classroom. Students who refuse to wear a mask and follow preventive COVID-19 guidelines will be dismissed from the class and will be subject to disciplinary action according to Section 1.2.3 *Health and Safety* and Section 1.2.2.5 *Disruptions* in the UTEP Handbook of Operating Procedures.

Please note that if COVID-19 conditions deteriorate in the City of El Paso, all course and lab activities may be transitioned to remote delivery.

#### COVID-19 PANDEMIC ACCOMMODATIONS

Students who use the screening application to report a positive COVID test, exposure or symptoms will not be allowed on campus and may need accommodations. If this occurs, you should contact me as soon as possible so we can arrange necessary accommodations. I will work with you, and if necessary the Dean of Students' office and the Center for Accommodation and Support Services (CASS), to provide reasonable accommodations.

Students who are considered high risk according to CDC guidelines and/or those who live with individuals who are considered high risk may contact CASS to discuss temporary accommodations for on-campus courses and activities.

#### 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  
Laboratory Report Grading Rubric

CATEGORY	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE
<b>Title Page, Heading and Signature</b> [0-5]	Includes all required information (Title, Module No., Name, Course, UTEP, <b>Due Date</b> , Electronic Signature). [5]	--	Missing any of the required information. [0]
<b>Objectives</b> [0-5]	Includes Objectives [5]	-	Missing objectives. [0]
<b>Introduction</b> [0-10]	Includes - thorough description of test article - test technique - equipment used - what was analyzed [8-10]	Missing only 1 requirement. [6-7]	Missing more than 1 requirement. [0-5]
<b>Lab Sections: Background, Procedures, Quality Assurance Tests, Results etc.</b> [0-55]	All subheadings are labeled appropriately, satisfies all content requirements outlined in module, includes images (photograph or diagram), and is easy to read and interpret. [45-55]	Missing only 2 requirements, and/or 2 format requirements, and/or needs to improve narrative. [30-44]	Missing more than 2 requirements, and/or format requirements, and/or needs to improve narrative. [0-29]
<b>Figure and Table Format</b> [0-10]	Includes figure and table captions, with necessary units and citations. Refers to all figures and/or tables within the text. [8-10]	Missing only 1 requirement: figure and table captions, units or citations. Refers to all figures and/or tables within the text. [5-7]	Missing figure and table captions, units or citations, and does not refer to figures and tables within the text. [0-4]
<b>Conclusions</b> [0-5]	Clearly states major conclusion(s) that were acquired as you worked through the module, correctly identifies and interprets indications observed. [5]	Missing conclusion(s) or conclusion(s) not supported by test results, incorrect interpretation or evaluation [3-4]	Incorrect testing yields incorrect conclusion(s) [0-2]
<b>Grammar</b> [0-5]	Proper capitalization, use of articles, subject-verb agreement, spelling, punctuation [5]	1 – 2 errors [3]	More than 2 errors [0]
<b>Overall Quality of Report (Content, Organization and Format)</b> [0-5]	Easy to read and interpret. Includes all content (sections) and format requirements (bold headings, figure/table formats, citation/reference formats) [5]	Contains all content, but difficult to read and interpret. [3-4]	Missing more than one format or content requirement, and difficult to read and interpret. [0-2]
<b>COMMENTS:</b>			

**GRADE (TOTAL PTS):**