# Syllabus: Introduction to Non-Destructive Testing and QA/QC, NDTE 1010

## Part 1: Course Information

## Description

This course provides students a synopsis of non-destructive and destructive evaluation methods that are used in evaluation of welds. This includes understanding the basic principles of various NDT methods, fundamentals, discontinuities in different product forms, importance of NDT, applications, limitations of NDT methods and techniques and codes, standards and specifications related to non-destructive testing technology. Students also will be introduced to relevant quality assurance and quality control requirements in accordance with ASQ, ASME, and ANSI standards.

This course is designed to meet over a period of 14 weeks, 1 meeting per week, and 3 hours per meeting in a combined lecture-lab meeting.

Prerequisites

None

Required Materials, Tools to be used See separate Excel Spreadsheet

## Part 2: Course Learning Outcomes (CLOs)

The course learning outcomes are to have students:

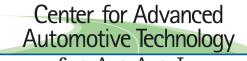
## **General Objectives**

Upon completion of this course, students will be able to

- 1. Be able to List and define different defects that occur in welding shown through Non-Destructive Examination/Destructive Testing.
- 2. Be able to identify the types of equipment used for each Non-Destructive and Destructive Examination.
- 3. Be able to explain the purpose of the Equipment, Application, and standard techniques required to perform major non-destructive and destructive examinations of welds.
- 4. Be able to go to specific Code, Standard, or Specification related to each testing method.
- 5. Have the knowledge and essential skills to identify strengths and weaknesses in materials used in fabrication





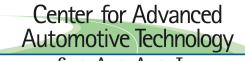


#### **Detailed Learning Objectives (DLOs)**

- Explain why NDT methods were initially developed
- 2. Explain why Codes and Standards were initially developed
- Describe the uses of NDT
- 4. Name the various nondestructive test methods
- 5. Recognize the NDT method abbreviations
- 6. Briefly explain each NDT method
- 7. Describe the advantages and limitations of VT
- Explain qualification and certification requirements for VT
- 9. Identify VT inspection tools
- Explain the differences between direct and remote VT
- 11. Describe manufacturing processes for metals
- 12. Explain the discontinuities inherent in various manufacturing processes
- 13. Name the various welding discontinuities
- 14. Define the causes, prevention, and repair of those welding discontinuities
- 15. Explain the discontinuities inherent in various welding processes
- 16. Provide the purpose of welding and NDE symbols
- 17. Describe the various weld configurations and joint types
- 18. Name the basic elements of welding and NDE symbols
- 19. Explain the supplementary welding and NDE symbols
- 20. Describe how welds are measured for acceptable size and length
- 21. Name the six basic steps for PT testing
- 22. Explain the mechanics of liquid penetrant
- 23. Name the types of liquid penetrants
- 24. Name the removal methods and types of removers
- 25. Name the types of developers
- Explain the advantages and disadvantages of PT
- 27. Describe the basic principles of MT
- 28. Name the four basic steps of MT
- 29. Explain the advantages and disadvantages of MT
- 30. Describe the types of MT equipment
- 31. Name the types of MT media
- 32. Explain the types of magnetizing current
- 33. Name the person that discovered X-rays
- 34. Name the types of radioactive sources used for RT
- 35. Explain radioactive half-life
- 36. Describe the various types of RT equipment
- 37. Describe the basic principles of gamma and X-ray generation
- 38. Name the three means of protection to help reduce exposure to radiation
- 39. Explain how radiation measuring devices are used and list the types of measuring devices
- 40. Describe the basics of producing a radiograph
- 41. Explain geometric unsharpness and other geometric principles







42.	Name and	describe t	the various	types of R	T
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- 43. Identify, and accept or reject RT discontinuities based on acceptance criteria
- 44. Explain the advantages and disadvantages of RT
- 45. Explain the basic principles of sound
- 46. Name the four wave modes used for UT
- 47. Describe the function of a piezoelectric transducer
- 48. Explain how ultrasonic thickness gages measure thickness
- 49. Describe the various UT techniques for flaw detection
- 50. Explain why calibration is necessary for UT equipment
- 51. Describe the advantages and limitations of UT
- 52. Name and describe the three scan data presentation methods
- 53. Explain the phased array UT technique
- 54. Describe the types of alloy identification equipment
- 55. Explain the principles of alloy identification
- 56. Describe how ECT is performed
- 57. Explain the principles of ECT
- 58. Gain a greater understanding about an NDT lab





# Part 3: Course Topics and Roadmap

## Roadmap

The following roadmap is recommended for instructors

Week	Lecture Topics	Main Concepts, Terms, and Skills	• Course
		• • • • • • • • • • • • • • • • • • • •	Materials,
	• DLOs		Homework &
			Projects
	State the topic of the week and list the CLO's by number	Provide a bulleted list of 3-4 subtopics for the week	List PPT name or slide #'s, and any homework, quiz, exam or project.
1	<ul><li>Introduction /</li></ul>	What is NDT?	• NDT_Week_
	History	Historical disasters that affected the	1_Intro-
	• 1,2,3	development of NDT	History.pptx
		The birth of Codes and Standards	• Lab
		NDT Qualification and Certification	
2	NDT Methods	Basic overview of 13 NDT methods	• NDT_Week_
	• 4,5,6	Abbreviations of those methods	2_Methods.p
			ptx
			• Lab
3	<ul> <li>Visual Testing</li> </ul>	Advantages and Limitations of VT	• NDT_Week_
	(VT) Part 1	VT Qualification and Certification	3_VT Part
	• 7 thru10	Welding Gages for VT	1.pptx
		Direct and Indirect VT	• Lab
4	<ul> <li>Visual Testing</li> </ul>	Discontinuities in manufacturing processes	• NDT_Week_
	(VT) Part 2 -	Discontinuities in welding processes	4_VT Part
	Discontinuities	Cause, prevention, and repair of welding	2.pptx
	• 11 thru 15	discontinuities	• Lab
		Performing VT	
5	<ul> <li>Welding Symbols</li> </ul>	Purpose of welding and NDE symbols	<ul><li>NDT_Week_</li></ul>
	• 16 thru 20	Basic elements of welding and NDE symbols	5_Welding
		Supplementary welding and NDE symbols	Symbols.pptx
		Practical application of welding symbols	• Lab
6	• Liquid Penetrant	Basic steps of PT	• NDT_Week_
	Testing (PT)	Mechanics of PT	6_PT.pptx
	• 21 thru 26	Types of penetrants, removers, and developers	• Lab
		Performing PT	
7	Review for Mid-	Review previously covered topics for Mid-Term	• NDT_Week_
	Term Exam	Exam	7_Mid-





			Term_Revie w.pptx
8	Magnetic Particle	Basic principles of MT	• NDT Week
	Testing (MT)	Four steps of MT	8 MT.pptx
	• 27 thru 32	MT equipment and media	• Lab
		Performing MT	
9	Radiographic	Types of RT sources	• NDT_Week_
	Testing (RT) Part	Radiation	9_RT Part
	1	RT equipment	1.pptx
	• 33 thru 39	RT Safety	• Lab
10	Radiographic	Producing a radiograph	• NDT_Week_
	Testing (RT) Part	RT image quality	10_RT Part
	2	RT discontinuities	2.pptx
	• 40 thru 44		• Lab
11	Ultrasonic Testing	Principles of sound	• NDT_Week_
	(UT) Part 1	UT equipment	11_UT Part
	• 45 thru 51	UT measurements and flaw detection	1.pptx
		UT calibration	• Lab
12	<ul> <li>Ultrasonic Testing</li> </ul>	Data scan presentation methods	<ul><li>NDT_Week_</li></ul>
	(UT) Part 2 / Alloy	Phased array UT	12_UT Part 2
	Identification /	Alloy identification	and Alloy
	Eddy Current	Eddy Current Testing (ECT)	Identification
	Testing (ECT)		.pptx
	• 52 thru 57		• Lab
13	Field Trip to Local	View lab equipment	<ul><li>NDT_Week_</li></ul>
	NDT Lab	Discuss careers in NDT	13_Field
	• 58		Trip.pptx
14	<ul> <li>Review for Final</li> </ul>	Review previously covered topics for Final	<ul><li>NDT_Week_</li></ul>
	Exam	Exam	14_Final_Rev
			iew.pptx

Note that my comments moved week 7 to the next page, making the table look better. You can do this in the final document with some spaces.

## Part 4: Grading and Assessment

### **Graded Assignments**

Students will perform graded lab experiments on welded samples. Lab reports are submitted for grading. At the instructor's discretion, quizzes and tests may also be used.

### **Proposed Grading Schedule**

Lab Reports (13)	60%
Midterm (1)	20%
Final Exam (1)	20%







# Part 5: Notes to Program Administrators Resources

Listed in separate document

## Instructor Qualification

- · Bachelor's or higher degree in a qualifying field or
- Bachelor's or higher degree in any discipline and certifying credentials:
  - 30 undergraduate hours or 18 graduate hours of coursework in a qualifying field, or
- Bachelor's or higher degree with relevant supplemental experiential experience:
  - o Two years professional employment or
  - o Research or publications, or
- A.A.S. in a qualifying discipline and four years of relevant professional employment

## **Qualifying fields:**

Metallurgical Engineering
Mechanical Engineering
Construction Technology
Quality Assurance/Quality Control Technology

### Prepared by

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