Lakeland Community College COURSE SYLLABUS

WELD 2400 Welding Inspection 3 credits

Lecture
Lab
Instructor: NAME OF INSTRUCTOR
Contact: Email: alternate:
Phone: cell: alternate:

Textbook Required:

HELP/TUTORING:

Available at the Learning Center Office, Rm A1044 Phone 525-7019

COURSE DESCRIPTION:

This course introduces students to the basic inspection procedures and processes utilized in the welding industry. Topics include safety concerns; the role of a welding inspector; relevant documents; requirements of a weld; types of defects; acceptance criteria; inspections and verifications performed prior to, during and after welding operations; visual inspection; destructive and nondestructive tests and metallography. Laboratory experience provides skill development in evaluating welds through visual examination using various related measuring instruments, nondestructive examination using liquid penetrant, magnetic particle, ultrasonic, and eddy current tests, and the preparation and examination of metallographic specimens. Students must furnish safety glasses for use in the laboratory.

RATIONALE FOR COURSE:

This course provides the knowledge and practical experience necessary for students to understand and perform inspection procedures typically utilized in the welding industry. This course will provide a pathway for employment in the welding industry as a testing or inspection technician or as a welder responsible for guaranteeing the quality of welds made.

COURSE OBJECTIVES, at the conclusion of this course, the student should be able to:

1. Identify and apply appropriate safety procedures when working as a welding inspector or performing work related to the inspection of weldments.
2. Describe the types of tasks typically performed by a welding inspector.
3. Give examples of typical requirements that might be specified for a weld.
4. Perform visual examinations of fillet and groove welds and determine if the welds meet the applicable acceptance standards.
5. Identify and describe nondestructive tests commonly used to evaluate weld.
6. Evaluate a weld by performing liquid penetrant and magnetic particle tests and determine whether the weld meets the applicable acceptance requirements.
7. Identify and describe the basic mechanical properties of base materials and weldments, and identify the destructive tests used to quantify those properties for a specific piece of material or weldment.
8. Prepare metallographic micro- and macro-specimens and explain what types of information they can provide.

COURSE OUTLINE

I. Safety
   A. Health and safety concerns
      1. General concerns when in an industrial facility
      2. General concerns when on a construction site
      3. General concerns when welding or when close to a welding operation
      4. Specific concerns associated with welding inspection
   B. Use of protective equipment
   C. Avoid potentially dangerous situations and follow safety procedures

II. Introduction to Welding Inspection
   A. Purpose, scope and importance
      1. Role of Quality Assurance
         a. Interaction of welders and inspectors
   B. Types of inspections and other activities involved
      1. Review of relevant prints, documents, material test reports, etc.
      2. Pre-weld verifications - materials, joints, fit-up, preheat, welder qualification, proper process and conformance to WPS requirements, etc.
      3. In-process inspections and verification of compliance with WPS requirements including settings, interpass temperature limits, heat input, etc.
      4. Inspection and testing of completed weldment
         a. Visual inspection
         b. NDT evaluations
         c. Verification that post-weld heat treatments, etc. were done
      5. Other
         a. Write report of inspections and verifications, date and sign
   C. Career paths and type work performed
      1. Welding Inspector
         a. AWS Certified Welding Inspector
      2. Testing Lab Technician
      3. NDT Test Specialists
         a. Includes PT, MP, UT, RT and other
         b. ASNT Certified Levels I, II and III
      4. Other
         a. Welding Supervisor
         b. Testing Equipment Sales Specialist

III. Relevant Documents
   A. Engineering Drawings and Shop Drawings
   B. Applicable Codes, Standards and Specifications
   C. Material certifications
   D. Welding Procedure Specification (WPS), also WPQR
   E. Welder Qualification Test Record
   F. Work Instructions

IV. Requirements of a Weld
   A. Physical dimensions, shape, reinforcement and depth of penetration
   B. Limits on surface irregularities and roughness
   C. Limits on internal and surface discontinuities
   D. Mechanical properties (strength, toughness, hardness, other)
   E. Chemical and metallurgical (ferrite content, sensitization, other)

V. Weld Defects

A. Defects are discontinuities within or on the surface of a weld, or unacceptable physical irregularities relating to shape, smoothness, etc.

1. Not all discontinuities are defects

a. Depends on size, shape and type

B. Types of discontinuities

1. Cracks

a. Never acceptable regardless of size

b. Surface, internal and underbead

c. Longitudinal and transverse

d. Hot cracks vs hydrogen-induced cold cracks

e. Crater

2. Incomplete fusion

3. Incomplete penetration

4. Overlap

5. Undercut

6. Inclusions

7. Porosity

a. Surface and internal

b. Scattered/Random

c. Linear

d. Elongated

e. Wormhole

C. Acceptance criteria

1. Typically specified for each type in applicable code or weldment specification written by customer, manufacturer or design engineer

VI. Visual Inspection Of Welds

A. Things to be measured or checked

1. Physical dimensions

a. Location, size, length, spacing

b. Profile, roughness and excessive reinforcement

c. Mismatch

d. Underfill

e. Unfilled craters

f. Incomplete penetration

2. Visible discontinuities that might be defects

a. Cracks (including crater cracks)

b. Overlap (rollover)

c. Undercut

d. Porosity

e. visible inclusions

f. Arc strikes

3. Other

a. Excessive oxidation or discoloration

b. Excessive spatter

B. Inspection instruments, gauges and aids

1. Instruments

a. Tape measure

b. Digital caliper

c. 6-inch machinists scale (64ths of an inch)

d. Bevel protractor

2. Gauges

a. Multi-piece, adjustable and combination types of fillet weld gauges

b. Bridge/cam gauge

c. V-WAC gauge

d. Hi-Lo gauge

e. AWS butt/fillet bridge gauge

f. Tapered gap gauge

g. Other special purpose types
3. Aids
a. Flashlight
b. Magnifying glass

VII. Metallography
A. General introduction
1. Reasons for use
2. Micro and Macro specimens
3. Equipment
B. Preparation of specimens
1. Cutting, sanding and polishing of specimens
2. Etching
C. Examination

VIII. Destructive Testing
A. Types of mechanical properties related to welding and significance
1. Tensile and Yield Strength
2. Ductility
3. Hardness
4. Toughness
5. Fatigue properties
6. Influence of temperature and service environment on properties
B. Test methods, equipment and instruments
C. Typical types of test specimens
D. Standards relating to mechanical property testing

IX. Nondestructive Testing
A. General Introduction
1. Reasons for use
2. Types of tests commonly used, type defects found and limitations
a. Liquid penetrant (PT)
b. Magnetic particle (MT)
c. Ultrasonic (UT)
d. Radiographic (RT)
e. Other – Eddy current, Acoustic emission, etc.
B. Equipment and instruments
C. Applicable Standards and certification of inspectors

X. Understanding and Using Codes and Specifications, Record Keeping, Etc.
A. General Introduction
1. Why important
2. Codes, standards and specifications related to welding
3. Differences between a code, specification and a standard
B. Codes
1. Information typically presented in a code and order of presentation
2. Typical codes relating to welding
C. Welding Procedure Specifications
1. Information typically presented in a WPS and significance
D. Welder Qualification Test Record
1. Information typically presented in a WQTR
a. Time sensitive – importance of record keeping and checking records
E. Other applicable requirements to be aware of that require compliance
1. Local, state and federal laws and regulation
F. Resolving disposition of rejected welds
1. Per Material Review Board, Supervisor, Engineer, etc.

FEDERAL CREDIT COMPLIANCE STATEMENT:

It is expected that students will spend two to three hours, minimally, outside of the classroom/laboratory performing course related work such as reading, research, homework assignments, practice, studio work, and other academic work for every hour of instruction spent in the classroom/laboratory.

STUDENTS WITH DOCUMENTED DISABILITIES:

Lakeland Community College is committed to providing all students equal access to learning opportunities. The Student Accommodation Center works with students with documented disabilities to provide and/or arrange reasonable accommodations. If you have a disability (e.g. learning, attention, psychiatric, vision, hearing, physical, or systemic) and feel it may create a barrier to your education, contact the Student Accommodation Center at 440-525-7020 or stop by the office, Room A-1042.

SUBSTANCE ABUSE NOTICE:

The Lakeland Community College Welding Program is committed to a safe learning environment in the classroom and the laboratory. Students are expected to report to lecture and lab classes properly prepared and unimpaired by alcohol and/or drugs. If the instructor believes a student is under the influence of alcohol and/or drugs, the instructor will ask the student to leave the classroom to ensure the health and safety of all students. Any student asked to leave the classroom faces potential Student Conduct Code charges.

ACADEMIC INTEGRITY:

Honesty, as the basic component of trust is essential to both individual and institutional integrity. With this premise in mind, Lakeland Community College has set forth certain behaviors as being forms of academic misconduct, and thus potentially diminishing Lakeland's integrity, reputation for academic quality, and ability to function as an academic community. The institution's faculty and administration, therefore, regard academic misconduct as a serious offense. Established as violations of academic misconduct at Lakeland Community College are cheating, plagiarism, fabrication of material included in academic work, denying others access to information or material, enabling academic misconduct, and deception in order to gain academic advantage. Policies dealing with violations of academic misconduct may be obtained by visiting http://www.lakelandcc.edu/web/about/student-development or from the Student Development Office.

GRADING:

The final grade for this three-credit hour course will be calculated based on scores achieved on attendance, homework, quizzes, a midterm exam and a final exam. The instructor has the option of grading on a curve if the average grade is less than 80%.

		BASIS FOR GRADES:
91 – 100%	= A	
83 - 90.99%	= B	Attendance (Missing 20% of classes = 0) --- 20%
75 – 82.99%	= C	Homework ---------- 10%
68 – 74.99%.....	= D	Laboratory Assignments----------15%
67.99 or below	= F	Quizzes ---------- 10%
Failure, non-attendance	= FNA	Midterm ---------- 20%
		Final Exam ---------- 25%
		Total --- 100%

ATTENDANCE (20% of final grade):

Attendance is a very important part of this course since the Instructor will at times be presenting and explaining information in the lecture sessions that will not be in the text book but may be included in quizzes and exams. Furthermore, employers expect employees to show up on time for every scheduled work day and this attendance requirement is intended to help students develop this ability.

ON THE FIRST DAY OF CLASS: You should make arrangements with two or more classmates so if you are late or have to be absent you can get any missed assignments from them. As you are expected to attend every class it is not the instructor's responsibility or obligation to re-teach material to students who are absent.

IF YOU ARE LATE OR ABSENT: A student can be late for class one time; thereafter, arriving late will count as being absent for half a class. This course consists of 16 classes, so each class missed will reduce student's final course score by 6.25% and missing three classes will result in 20% of students final course score being zero.

LABORATORY WORK/HOMEWORK: (25% of final grade):

Students will frequently be given laboratory work or homework assignments, such as answering end-of-chapter questions or completing an alternate assignment handed out in class, such as measuring lines or distances, creating a 3-view drawing, putting weld symbols on a drawing, etc. Homework turned in late will only get half credit. Students will, however, be given an opportunity to make up lost points by (a) participating in voluntary plant tours or (b) researching the facility offering the tour and then writing a cover letter with a resume applying for employment at that facility and submitting it to the class Instructor or (c) attending an American Welding Society meeting or event.

QUIZZES: (10% of final grade):

Quizzes will not necessarily be announced in advance; therefore, it is important for students to arrive on time for every class. Students who arrive late to class will not be given additional time to complete a quiz. In this course the lowest quiz score will be dropped when the student's course grade is being calculated. Students will not be allowed to make up a missed quiz. The Instructor has the discretion to include pop-quizzes as part of their teaching method and students should be prepared for this to be done in this course.

EXAMS: (Midterm – 25% of final grade; Final – 25%):

Exams will commence and terminate at the pre-announced time. It is the student's responsibility to arrive on time and complete the exam within the stated time. No additional time will be given. If a student is ill on the scheduled Midterm or Final Exam dates, he/she must phone the Instructor at least one hour before the exam is to begin. If you reach voice mail or an answering machine leave a message, clearly stating and spelling your first and last names and provide your telephone number including area code. In this message, state when you plan to take the missed exam in the Lakeland Learning Center testing room (A-1040). **NOTE: The exam must be taken within 48 hours of its scheduled administration time to avoid penalty unless an alternate time is arranged with the Instructor before the 48 hour deadline has passed.** Students must provide a picture ID for the Testing Center monitor. The student is responsible for determining Testing Center hours.

COURSE POLICY:

The policies and procedures for this course shall be consistent with the college policies and procedures explained in the current Student Handbook and Calendar.

Cell phones are to be turned off or silenced in class and lab, and photographing or video recording of class sessions and/or materials presented is not allowed without the Instructor's permission. Cell phones cannot be used during quizzes or exams, and the Instructor reserves the right to collect and hold them while quizzes or tests are being taken. Non-compliance with this policy may result in a student being expelled from class.

Adds, drops, and withdrawals are per standard policies of Lakeland Community College. A student's failure to attend the class does not constitute a withdrawal and will ultimately lead to a failing grade. Those who wish to withdraw from class should contact the Counseling Center to initiate the withdrawal procedure.

For cancellations due to bad weather, call the Lakeland Emergency Closing Hotline at (440) 525-7242, or check Lakeland's web page, local radio or TV stations.

Methods of Presentation:

Text book reading assignments
Lecture
Audio/Visual Media
Demonstration
On-line presentation

Individualized instruction

The policies, requirements and other information contained in this syllabus are subject to change at the discretion of the Instructor

LAKELAND COMMUNITY COLLEGE'S MISSION STATEMENT:

"To provide quality learning opportunities to meet the social and economic needs of the community."

Lakeland Community College Learning Outcomes

Learns Actively
Thinks Critically
Communicates Clearly
Uses Information Effectively
Interacts in Diverse Environment
Essential skills for personal and professional growth

COURSE SCHEDULE:

Class #	Date:	Topic:	Preparation/Comments:
1			
2			
3			
4			
5			
6			
7			
8			
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10			
11			
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16			

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The course and services are available without regard to a participant's race, color, religion, ancestry, age, handicap, sex, marital status or national origin. The number for TDD/TYY or relay services is 440-525-7006.

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