I. INTRODUCTION

A. Advanced topics in GMAW welding, including welding in various positions and directions.

B. Advanced Gas Metal Arc Welding (GMAW) (WLDG 2447) is a required course for the completion of a Level I or II Certificate of Completion in the Welding Technology Program.

C. This course is occupationally related and serves as a preparation for a career in the Welding field.

D. Prerequisites: This course has a prerequisite of WLDG 1430 or consent of the Dept. Chair.

E. Alphanumeric coding used throughout this module book denotes integration of SCANS occupational competencies (C1, etc.) and Foundation skills (F1, etc.).

II. LEARNING OUTCOMES

Upon successful completion of this course, Advanced Gas Metal Arc Welding (GMAW) the student will:

A. The student will exhibit expertise in various welding positions on pipe. (C18, 19, 20)

B. Describe safety rules and equipment use. (C7)(F6)

C. Describe the effects of welding parameters in GMAW. (C7)(F6)

D. Weld various joint designs. (C18, 19, 20)

E. Diagnose welding problems and perform visual inspections. (F9)

F. Explain the basic theory of flux core welding. (C7)(F6)

G. Define flux core welding terms. (C7)(F6)

H. Demonstrate knowledge of flux core welding. (C18, 19)

I. Identify flux core welding equipment and components. (C18)

J. Properly set-up flux core welding equipment for a project. (C18, 19)

K. Discuss metal transfer in flux core welding. (C7)

L. Discuss filler metals. (C7)

M. Prepare plates for welding. (C18, 19)
N. Prepare test coupons. (C18, 19)
O. Discuss aluminum welding. (C7) (F6)
P. Identify aluminum welding equipment and components. (C18)
Q. Select materials. (C3)
R. Perform aluminum welding operations. (C18, 19)
S. Properly and safely use and maintain tools and equipment. (C2)
T. Practice shop safety. (F12)

III. INSTRUCTIONAL MATERIALS

A. Instructional materials for this course may be found at www.ctcd.edu/books
B. Supplemental Reading: As assigned by the instructor.
C. Audio-visual aids: See resource list at end of this module book.
D. Other instructional material: as selected by the instructor.

IV. COURSE REQUIREMENTS

A. This course is being taught in a self-paced mode. It differs from the traditional college course in that you are allowed to work on your own and at your own speed within limitation. This course is 96 clock hours in length. The student may set his/her own schedule within the time frame the course is offered. You must attend class on the days and at the times you selected when you enrolled in the course.

You will have an assigned instructor. If at any time you do not understand a reading assignment, audio visual presentation or lab work, ask your instructor for assistance. He is there for you!

This module book is designed to inform you of the sequence in which this course will be presented. You must follow this sequence and you must do what the module book says. It contains reading assignments, written assignments, audio visual presentations and lab assignments that you must complete or watch. Written assignments will be turned in as directed by the instructor. Late assignments will not be accepted. You must let your instructor know when you are ready to do a learning activity, performance exam or take a scheduled exam.

B. The student must take notes when viewing filmstrips, slides, or videos. Exams may be taken from audio visual aids, reading and lab assignments. If instructor notes or handouts are given to you, you must study them; exams may be taken from these notes also.

C. The instructor may give written assignments or "pop" quizzes as he deems necessary.
D. Performance Exams:
Each student will clean all tools and equipment that they use and properly store them and clean their work area after the completion of each task.

Certificate Students: All lab work will be completed on an individual basis. The student will receive a "pass" or "fail" grade on the task. Students who fail to complete a task correctly to industry standards must repeat the task. The instructor will date and initial each performance exam task as it is satisfactorily completed. NOTE: Students who have selected the Alpha-Numeric grading system will be graded as outlined for degree students (see below).

Degree Students: Laboratory tasks (performance exam) will be completed on an individual basis except when limited by tools and/or materials. Each performance exam is worth a maximum of 5.9 points. The maximum lab grade is 100 points. The instructor will deduct points from each lab task score for failure to follow safety precautions and/or a failure to complete the project to industry standards. The instructor will date, initial, and post the points earned for each performance exam as it is completed.

E. The following is part of the course requirements: Each student will assist in lab clean-up at the close of the evening classes and will assist in unloading and storing supply shipments. Failure to do so will result in a failure to complete all course requirements and the student could receive an "N" for the course.

F. There will be five (5) written examinations in this course (4 module/unit exams and an exit exam). Written exams must be completed before taking the performance exam for each module. The exit exam is a comprehensive exam that covers the entire course. Certificate students must score 70% on the exit exam. Certificate students will be allowed to take the exit exam a maximum of three (3) times. Failure to achieve a 70% score on the exit exam in three (3) tries will result in an "N" or "F" for the course and the student must retake the course. Degree Students should refer to the "grading" section of this outline for guidance.

G. The student must complete the written assignments to receive a grade. Written assignments for each unit will be turned into the instructor prior to starting performance exams for that module. Degree students must complete reading and written assignments at home.

H. If you have special needs because of learning disabilities or other kinds of disabilities, please feel free to discuss this with the instructor. The instructor will attempt to meet your needs with the assistance of counselors, tutors (Project Mainstream), and the assistance of the Disabilities Services Office. Program/course integrity will not be sacrificed. Students must meet all course requirements.
GRADING

Certificate Students: Students will be graded using the standard Skills Center "Pass-Fail" or “Alpha-Numeric” system used for self-paced programs. To satisfactorily complete the written exams, the student must score 80% on tests (except the exit exam, 70%). Students who fail to make the 80% on any exam (except the exit exam) must retake the exam. The current test re-take policy will apply to all certificate students. The student must satisfactory complete all written and performance exams to receive a passing grade ("P").

Degree Students: Students will be graded using an "Alpha-Numeric" system as outlined below. Grades made on performance and written exams will be the grade received, including the exit exam. Students will not be allowed to retake written exams or redo performance exams.

A. Written exams: Average of written exams will count 40% of the final grade.

B. Completion of written assignments/activities will count 10% of the students final grade.

C. Performance Exams (Lab work) will count 50% of the final grade.

D. Grade Computations: (Example)
Written Exam Scores: (There will be 4 written exams)
Exam 1  90
Exam 2  80
Exam 3  70
240 divided by 3 = 80 (Average Written Exams)

Written Exam Score Average  80 x 40%  = 32 points
Written Assignments  100 x 10%  = 10 points
Performance Exam Score  80 x 50%  = 40 points

Total = 82 points = P

V. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE COURSE INSTRUCTOR

A. Course Withdrawal: It is the student’s responsibility to officially withdraw from a course if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application for Withdrawal (CTC Form 59). The withdrawal form must be signed by the student.

CTC Form 59 will be accepted at any time prior to Friday of the 12th week of
classes during the 16-week fall and spring semesters. The deadline for sessions of other lengths is:

<table>
<thead>
<tr>
<th>Session Length</th>
<th>Deadline</th>
</tr>
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<tbody>
<tr>
<td>10-week session</td>
<td>Friday of the 8th week</td>
</tr>
<tr>
<td>8-week session</td>
<td>Friday of the 6th week</td>
</tr>
<tr>
<td>5-week session</td>
<td>Friday of the 4th week</td>
</tr>
</tbody>
</table>

The equivalent date (75% of the semester) will be used for sessions of other lengths. The specific last day to withdraw is published each semester in the Schedule Bulletin.

A student who officially withdraws will be awarded the grade of “W” provided the student’s attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the College before they may be considered for withdrawal.

A student may not withdraw from a class for which the instructor has previously issued the student a grade of “F”, “N”, “FN”, or “XN” for nonattendance.

B. Administrative Withdrawal: An administrative withdrawal may be initiated when the student fails to meet College attendance requirements. The instructor will assign the appropriate grade on CTC Form 59 for submission to the registrar.

C. Incomplete Grade: The College catalog states, "An incomplete grade ("IP") may be given in those cases where the student has completed the majority of the coursework but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course." Prior approval from the instructor is required before the grade of "IP" for Incomplete is recorded. A student who merely fails to show for the final examination will receive a zero for the final and an “F” or “N” for the course.

D. Cellular Phones and beepers: Cellular phones and beepers will be turned off while the student is in the classroom or laboratory.

E. American’s With Disabilities Act (ADA): Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Explore the website at [www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support) for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

F. Instructor Discretion: The instructor reserves the right of final decision in course
requirements.

G. Civility: Individuals are expected to be cognizant of what a constructive educational experience is and respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

H. Absence from the class may be unavoidable in some situations. These include illness, military/civilian job requirements, or a death in the immediate family. Documentation is required in the case of excused absences for job requirements. Excuses will be on company letterhead stationary signed by the immediate supervisor stating the reason for the absence for civilian jobs. Excuses for military personnel must be signed by the 1st Sergeant or the Company Commander. **NOTE: This does not apply to VA, VA/Voc, or Financial Aid students. There are no excused absences for these students. Talk to your funding agency if you have questions.**

I. Tools/Equipment required

Welding helmet and jacket, safety glasses, gloves, and chipping hammer.

### VI FIRST CLASS MEETING

A. The instructor will introduce the course and show the student the textbook.

B. The instructor will verify the class roster/enrollment form:

1. Call roll
2. Have each student verify the spelling of his/her name and the social security number by initialing the class roster/enrollment form.  
   **NOTE:** When a student=s name does not appear on the degree program class roster, they must bring it to the attention of the instructor and must present the instructor with CTC Form 29 (Add/Drop Slip) reflecting that he/she has properly registered for the course.

C. The instructor will have the student read and sign the course requirements sheet.

D. The instructor will discuss the following topics with the student:

1. Course requirements, objectives and how the course works
2. Policy letters
3. Student handouts
4. Lab sheet and lab work (Learning activities, Performance exams, competency profile)
5. Exam, grading, reading and written assignments.
6. Absences
7. Shop/classroom cleanup/tools
COURSE OUTLINE OR SEQUENCE

I. Module 2447-01: Flux Core Arc Welding

A. Time:
   Certificate Student: 10 Clock Hours
   Degree Student: 2 (1*) weeks

B. Module Learning Outcomes: Upon completion of this module the student will:

   1. Describe safety rules and equipment use. (C7)(F6)
   2. Describe the effects of welding parameters in GMAW. (C7)(F6)
   3. Explain the basic theory of flux core welding. (C7)(F6)
   4. Define flux core welding terms. (C7)(F6)
   5. Demonstrate knowledge of flux core welding. (C18, 19)
   6. Identify flux core welding equipment and components. (C18)
   7. Properly set-up flux core welding equipment for a project. (C18, 19)
   8. Discuss metal transfer in flux core welding. (C7)
   9. Discuss filler metals. (C7)
  10. Prepare plates for welding. (C18, 19)

C. Review Chapters 2, 11, 18, and 27 in Resource 1323-01 as needed.

D. Read Chapter 12 in Resource 1323-01 and answer the review questions at the end of each chapter. Turn the assignment into the instructor when completed.

E. Read Factsheet 2447-01-01.

F. Complete Worksheet 2447-01-01.

G. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

H. View Audio Visuals: (See your instructor)

   1. Review the following audio visuals as needed:
      a. "Gas Metal Arc Welding", CEV #812 (Video) Resource 1430-01.
      b. "Introduction to Semi-Automatic Wire Welding", Lincoln Electric

2. View the following audio visuals:

I. See your instructor and ask him to demonstrate the set-up of flux core welding equipment.
J. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Learning Activities for this module. (See your instructor)
K. See your instructor and ask him if there is any additional information that you should read or see that pertains to this module.
L. Review for Module 2447-01 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain anything you do not understand.
M. Module 2447-01 Written Exam: (See your instructor)
N. Critique Module 2447-01 Written Exam: (See your instructor)
O. Performance Exam Module 2447-01: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor).
P. Certificate students should complete this module by the end of the 10th clock hour. Degree students should complete this module by the end of the 2nd (1st*) week.

II. Module 2447-02: Flux Core Welding Position 1G and 2G

   A. Time:
      Certificate Student 25 clock hours
      Degree Student 4 (2*) weeks

   B. Module Learning Outcomes: Upon completion of this module the student will:
      1. The student will exhibit expertise in various welding positions on pipe.
2. Describe safety rules and equipment use. (C7)(F6)
3. Describe the effects of welding parameters in GMAW. (C7)(F6)
4. Weld various joint designs. (C18, 19, 20)
5. Diagnose welding problems and perform visual inspections. (F9)
6. Explain the basic theory of flux core welding. (C7)(F6)
7. Define flux core welding terms. (C7)(F6)
8. Demonstrate knowledge of flux core welding. (C18, 19)
9. Identify flux core welding equipment and components. (C18)
10. Properly set-up flux core welding equipment for a project. (C18, 19)
11. Discuss metal transfer in flux core welding. (C7)
12. Discuss filler metals. (C7)
13. Prepare plates for welding. (C18, 19)
14. Prepare test coupons. (C18, 19)
15. Properly and safely use and maintain tools and equipment. (C2)
16. Practice shop safety. (F12)

C. Review Chapters 11, 12 and 20 in Resource 1323-01.

D. Read Chapter 13 in Resource 1323-01 and answer the review questions at the end of each chapter. Turn the assignment into the instructor when completed.

E. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

F. View Audio Visuals: (See your instructor)

View the following Audio Visual and review the Audio Visuals listed in Module 2447-01 as needed.

1. "Gas Metal, Flux Cord Arc Welding (MIG)" Bergwall #DF52-C7/8, parts 3 and 4 (CD ROM) Resource 1430-03.

G. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Learning Activities for this module. (See your instructor)

H. See your instructor and ask him if there is any additional information that you should see or read that pertains to this module.

I. Review for Module 2447-02 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain anything you do not understand.

J. Module 2447-02 Written Exam: (See your instructor)

K. Critique Module 2447-02 Written Exam: (See your instructor)
L. Performance Exam Module 2447-02: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Certificate students should complete this module by the end of the 35th clock hour. Degree students should complete this module by the end of the 6th (3rd*) week.

III. Module 2447-03: Flux Core Welding Position 3G and 4G

A. Time:
Certificate students 35 clock hours
Degree students 5 (4*) weeks

B. Module Learning Outcomes: Upon completion of this module the student will:

1. The student will exhibit expertise in various welding positions on pipe. (C18, 19, 20)
2. Describe safety rules and equipment use. (C7)(F6)
3. Describe the effects of welding parameters in GMAW. (C7)(F6)
4. Weld various joint designs. (C18, 19, 20)
5. Diagnose welding problems and perform visual inspections. (F9)
6. Explain the basic theory of flux core welding. (C7)(F6)
7. Define flux core welding terms. (C7)(F6)
8. Demonstrate knowledge of flux core welding. (C18, 19)
9. Identify flux core welding equipment and components. (C18)
10. Properly set-up flux core welding equipment for a project. (C18, 19)
11. Discuss metal transfer in flux core welding. (C7)
12. Discuss filler metals. (C7)
13. Prepare plates for welding. (C18, 19)
14. Prepare test coupons. (C18, 19)
15. Properly and safely use and maintain tools and equipment. (C2)
16. Practice shop safety. (F12)

C. Review Chapters 10, 11, 12, 13 and 20 in Resource 1323-01. You will be tested on this material.

D. See your instructor and ask him to explain any material that you do not understand.

E. View Audio Visuals: (See your instructor)
Review any of the audio visuals in Modules 2447-01 and 2447-02 as needed.

F. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Learning Activities for this module. (See your instructor)
G. See your instructor and ask him if there is any additional information that you should read or see that pertains to this module.

H. Review for Module 2447-03 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain anything you do not understand.

I. Module 2447-03 Written Exam: (See your instructor)

J. Critique Module 2447-03 Written Exam: (See your instructor)

K Performance Exam Module 2447-03: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

L. Certificate students should complete this module by the end of the 70th clock hour. Degree students should complete this module by the end of the 11th (7th*) week.

IV. Module 2447-04: Aluminum Welding (Spool-matic)

A. Time:
Certificate students 20 clock hours
Degree students 4 (3*) weeks

B. Module Learning Outcomes: Upon completion of this module the student will:

1. Prepare plates for welding. (C18, 19)
2. Prepare test coupons. (C18, 19)
3. Discuss aluminum welding. (C7) (F6)
4. Identify aluminum welding equipment and components. (C18)
5. Select materials. (C3)
6. Perform aluminum welding operations. (C18, 19)
7. Properly and safely use and maintain tools and equipment. (C2)
8. Practice shop safety. (F12)

C. Review Chapters 8, 9, 10 and 11 in Resource 1323-01. You will be tested on this material.

D. See your instructor and ask him to explain any material that you do not understand.

E. View Audio Visuals: (See your instructor)
There are currently no audio visuals for this module.
F. See your instructor and ask him to demonstrate the proper use of the Spool-Matic welding machine.

G. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Learning Activities for this module. (See your instructor)

H. See your instructor and ask him if there is any additional information that you should read or see that pertains to this module.

I. Review for Module 2447-04 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain anything you do not understand.

J. Module 2447-04 Written Exam: (See your instructor)

K. Critique Module 2447-04 Written Exam: (See your instructor)

L. Performance Exam Module 2447-04: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Certificate students should complete this module by the end of the 90th clock hour. Degree students should complete this module by the end of the 15th (10th*) week.

V. Module 2447-05: Exit Exam

A. Time:
   Certificate students: 6 clock hours
   Degree students: 1 week

B. Module Learning Outcomes: Upon completion of this module the student will:
   1. Use basic thinking skills and demonstrate personal qualities and work practices used in the work place.
   2. Complete the Exit exam.

C. Review for Exit exam: Review all previous assignments.

D. See your instructor and ask him to explain anything that you do not understand about welding safety, tools and equipment.

E. Module 2447-05 Exit Exam: (See your instructor) Degree students must complete this exam by the end of the 16th (11th*) week. Certificate students must complete their exam by the end of the 96th clock hour.

F. Critique Module 2447-05 Written (Exit) Exam: (See your instructor)
G. There is no performance exam for this module.

H. End of Course Critique and enrollment in the next course in the program. (See your instructor)