I. INTRODUCTION

A. Instruction using layout tools and blueprint reading with demonstration and guided practices with some of the following welding processes: oxy-fuel gas cutting and welding, shield metal arc welding (SMAW), gas metal arc welding (GMAW), flux-cored arc welding (FCAW), gas tungsten arc welding (GTAW), or any other approved welding process.

B. Intermediate Welding Using Multiple Processes (WLDG 2413) is a required course for the completion of a Level I or II Certificate of Completion in the Automotive or Diesel Technician Programs.

C. This course is occupationally related and serves as a preparation for a career in the automotive or Diesel career fields.

D. Prerequisites: This course has a prerequisite of ALL AUMT or DEMR courses in the applicable Degree Plans or consent of the Department 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, Intermediate Welding Using Multiple Processes, the student will:

A. The student will identify proper safety equipment and tools. (C18, 19)
B. Identify and select the proper welding process for a given application. (C18)
C. Demonstrate skills training using more than one approved welding process. (C18, 19)
D. Select the most economic and practical welding process for the given task. (F8)
E. Demonstrate ability to analyze situations and make decisions using skills as taught concerning safety and electrode selections. (C18, 19)
F. Discuss welding careers. (C7) (F6)
G. Explain the basics of welding and metallurgy. (C7) (F6)
H. Define joint and welding terms. (C7) (F6)
I. Identify and use protective clothing and equipment used in SMAW welding. (C18, 19)
J. Discuss welding currents and their applications. (C7) (F6)
K. Determine polarity and polarity changes. (C18, 19)
L. Explain heat proportion. (C7) (F6)
M. Discuss weld testing. (C7) (F6)
N. Explain the principles of gas metal arc welding (GMAW). (C7) (F6)
O. Properly and safely use and maintain tools and equipment. (C20)
P. 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 limitations. The course is 144 clock hours in length, and the student may set his/her own schedule within the time frame the course is offered. You must attend class on days and at the times you selected when you enrolled in the course.

You will have an assigned instructor. If at anytime 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 outline 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 take a scheduled exam or do a performance exam.

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

C. The instructor may give written assignments or “pop quizzes” as he deems necessary in the WLDG courses.
D. Each student will clean all tools and equipment that he/she uses and properly store them and clean the 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", "fail", or “Alpha-Numeric” 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 as directed by the instructor 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 six (6) written examinations in this course (a safety exam, 4 module/unit exams, and an exit exam). Students must score 80% on the safety exam before they proceed to the next task. **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" for the course, and the student must retake the course.

G. The student must complete the written assignments to receive a grade. **Written assignments for each unit will be turned in to 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.
V. GRADING

Students will be graded using the standard Skills Center "Pass-Fail" 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 satisfactorily complete all written and performance exams to receive a passing grade ("P").

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 student's final grade.

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

D. Grade Computations: (Example)

Written Exam Scores: (There will be 8 written exams)

<table>
<thead>
<tr>
<th>Exam</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
</tr>
</tbody>
</table>

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)

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:

- 10-week session: Friday of the 8th week
- 8-week session: Friday of the 6th week
- 5-week session: Friday of the 4th week

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, Personal Protective Equipment, Safety Glasses, Welding Gloves, Jacket, Pliers
   Suggested: 4 ½ grinder with wire bend brush

VI. **FIRST CLASS MEETING**

A. The instructor will introduce the course and show the student the textbook and/or resource(s).

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, he/she must bring it to the attention of the instructor and must present the instructor with CTC Form 29 (Add/Drop Slip) reflecting that he 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 (Enabling Tasks, Performance Exams)
   5. Exam, grading, reading, and written assignments
   6. Absences
   7. Shop/Classroom cleanup -- tools
   8. Dress Code
   9. Parking
   10. Sign-In Book or Computerized Sign-In Procedure
   11. Course Outline/Fact Sheets/Student Handouts
   12. Hazardous Communications/MSDS Information
   13. Shop Safety
COURSE OUTLINE OR SEQUENCE

I. Module 2413-01: Introduction to Welding and Welding Safety

A. Time:
   Certificate Students: 10 Clock Hours
   Degree Students: 2 weeks/1 week*

B. Module Objectives: Upon completion of this module the student should be able to:
   1. Discuss welding careers.
   2. Explain the basics of welding metallurgy.
   3. Define joint designs and welding terms.
   4. Explain and demonstrate welding safety practices.
   5. Identify welding symbols.
   6. Demonstrate SCANS and Foundation skills.
   7. The student will identify proper safety equipment and tools. (C18, 19)
   8. Identify and use protective clothing and equipment used in SMAW welding (C18, 19)
   9. Properly and safely use and maintain tools and equipment. (C20)
   10. Practice shop safety. (F12)

C. Read Chapter 2 of Resource 1323-01 and answer the review questions at the end of the chapter. The written assignment will be turned in when you take the safety exam.

D. See your instructor and ask him to explain any part of welding safety that you do not understand.

E. Safety Exam: (See your instructor)

F. Read Chapters 1, 20, 21 and 25 in Resource 1323-01 and answer the "Review Questions" at the end of each chapter as applicable. The written assignment will be turned in when you take your first exam.

G. Review the Glossary and Appendixes of Resource 1323-01.

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

I. View Audio Visuals: (see your instructor) Student must take notes.
   1. “Introduction to Welding”, CEV #839 (Video) Resource 2403-02
   2. “Welding Safety”, TP&L (no number), (2 Videos) Resource 1425-02
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 asked him if there is any additional information that you should read or see that pertains to this module.

L. Review for Module 2413-01 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

M. Module 2413-01 Written Exam: (See your instructor): (your work).

N. Critique Module 2413-01 Written Exam: (See your instructor)

O. Module 2413-01 Performance Exam: 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 2413-02: Oxyacetylene Cutting, Welding, and Brazing

A. Time:
Certificate Students: 45 Clock Hours
Degree Students: 4 (3*) weeks

B. Module Objectives: Upon completion of this module the student should be able to:

1. Identify and select the proper welding process for a given application. (C18)
2. Demonstrate skills training using more than one approved welding process. (C18, 19)
3. Select the most economic and practical welding process for the given task. (F8)
4. Demonstrate ability to analyze situations and make decisions using skills as taught concerning safety and electrode selections. (C18, 19)
5. Define joint and welding terms. (C7) (F6)
6. Identify and use protective clothing and equipment used in SMAW welding. (C18, 19).
7. Properly and safely use and maintain tools and equipment. (C20).
8. Practice shop safety
C. Read Chapters 7, 30, 31, 32 and 33 in Resource 1323-01 and answer the “Review Questions” at the end of each chapter as applicable. The written assignment will be turned in when you take your first written exam.

D. Study Fact Sheet 2413-02-01 to learn the components that make up a flame cutting and welding set.

E. Study Fact sheet 2413-02-02 to learn more about welded joints.

F. Study Fact sheet 2413-02-03 to learn more about setting up flame cutting equipment.

G. Study Fact sheet 2413-02-04 to learn more about butt joints.

H. Complete Self-Assessment 2413-02-01. Refer to the answer sheet to check your answers.

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

J. View Audio Visuals: (See your instructor) **Students must take notes.**
   1. "Oxyacetylene Cutting", CEV #816 (Video) Resource 1425-05
   2. "Oxyacetylene Welding", Voc Media #31500 (Video-3 parts) Resource 1425-08
   3. "Oxyacetylene Welding and Brazing", CEV #815. (Video) Resource 1425-09

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

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

M. Review for Module 2413-02 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

N. Module 2413-02 Written Exam: (See your instructor)

O. Critique Module 2413_02 Written Exam: (See your instructor)

P. Module 2413-02 Performance Exam: Refer to the Laboratory Learning Activities (Lab sheet) in this module book and complete the Performance exam for this module. (See your instructor)
Q. Certificate students should complete this module by the end of the 55th clock hour. Degree students should complete this module by the end of the 6th (4th*) week.

III. Module 2413-03: Shielded Metal-Arc Welding - (SMAW)

A. Time:  
Certificate student:  45 Clock Hours  
Degree student:  5 (3*) weeks

B. Module Objectives: Upon completion of this module the student should be able to:

1. The student will identify proper safety equipment and tools. (C18, 19)  
2. Identify and select the proper welding process for a given application. (C18)  
3. Demonstrate skills training using more than one approved welding process. (C18, 19)  
4. Select the most economic and practical welding process for the given task. (F8)  
5. Demonstrate ability to analyze situations and make decisions using skills as taught concerning safety and electrode selections.  
6. Define joint and welding terms. (C7) (F6)  
7. Identify and use protective clothing and equipment used in SMAW welding. (C18, 19)  
8. Discuss welding currents and their applications. (C7) (F6)  
9. Determine polarity and polarity change. (C18, 19)  
10. Explain heat proportion. (C7) (F6).  
11. Discuss weld testing. (C7) (F6)  
12. Properly and safely use and maintain tools and equipment. (C20)  
13. Practice shop safety. (F12)

C. Read Chapters 3, 4, 26 and 27 in Resource 1323-01 and answer the "Review Questions" at the end of each chapter as applicable. The written assignment will be turned in when you take your first written exam.

D. Read Fact sheet 2413-03-01 to learn more about electrodes.

E. Complete Self Assessment 2413-03-01.

F. Read Fact sheet 2413-03-02 to learn more about welding currents.

G. Read Fact sheet 2413-03-03 to learn about duty cycles.

H. Read Fact sheet 2413-03-04 to learn more about SMAW components.
I. Complete self assessment 2413-03-02.

J. Read Fact sheet 2413-03-05 to learn more about identifying good and bad
welds.

K. Read Fact sheet 2413-03-06 to learn more about typical welded joints and
positions.

L. Read Appendix VII in Resource 1323-01.

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

N. View Audio Visals: (See your instructor) Students must take notes.
      Resource 2413-01.
   2. "Shielded "Stick" Metal Arc Welding I", CEV #810 (Video) Resource
      2413-02.
   3. “Basic Electricity for Arc Welding”, Lincoln Electric #ED222 (Video)
      Resource 2413-03

O. Complete Practical Exercise 2413-03-01.

P. Complete Practical Exercise 2413-03-02.

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

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

S. Review for Module 2413-03 Written Exam: Study all previous assignments
   in this module. See your instructor and ask him to explain any area that you
do not understand.

T. Module 2413-03 Written Exam: (See your instructor)

U. Critique Module 2413-03 Written Exam: (See your instructor)

V. Module 2413-03 Performance Exam: Refer to the Laboratory Learning
   Activities (Lab Sheet) in this module book and complete the Performance
   exam for this module. (See your instructor)

W. Certificate students should complete this module by the end of the 100th clock
Degree students should complete this module by the end of the 11th (7th*) week.

IV. Module 2413-04: Gas Metal Arc Welding (GMAW)

A. Time:
   Certificate students: 38 clock hours
   Degree students: 4 (3*) weeks

B. Module Learning Outcomes: Upon completion of this module the student should be able to:

1. The student will identify proper safety equipment and tools. (C18, 19)
2. Identify and select the proper welding process for a given application. (C18).
3. Demonstrate skills training using more than one approved welding process. (C18, 19)
4. Select the most economic and practical welding process for the given task. (F8).
5. Demonstrate ability to analyze situations and make decisions using skills as taught concerning safety and electrode selections. (C18, 19)
6. Define joint and welding terms. (C7) (F6).
7. Identify and use protective clothing and equipment used in SMAW welding. (C18, 19)
8. Discuss welding currents and their applications. (C7) (F6)
9. Determine polarity and polarity changes. (C18, 19)
10. Explain heat proportion. (C7) (F6)
11. Discuss weld testing. (C7) (F6)
12. Explain the principles of gas metal arc welding (GMAW). (C7) (F6)
13. Properly and safely use and maintain tools and equipment. (C20)
14. Practice shop safety. (F12)

C. Read Chapters 10, 11, 12 and 13 in Resource 1323-01 and answer the "Review Questions" at the end of each chapter as applicable. The written assignment will be turned in when you take your first written exam.

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

E. View audio visuals (See your instructor) Student must take notes.

1. “Millermatic 250 MP Set up and Operation”, Miller Electric MFG Co. #149752 (video) Resource 2413-04
2. “Gas Metal Arc Welding”, CEV #812 (video) Resource 1430-01
F. See you instructor and ask him to demonstrate GMAW equipment and procedures.

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 asked him if there is any additional information that you should read or see that pertains to this module.

I. Review for Module 2413-04 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 2413-04 Written Exam: (See your instructor)

K. Critique Module 2413-04 Written Exam: (See your instructor)

L. Module 2413-04 Performance Exam: 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 138th clock hour. Degree students should complete this module by the end of the 15th (10th*) week.

V. Module 2413-05: 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 Module 2413-05 Written (Exit) Exam: Review all previous assignments.

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

E. Module 2413-05 Written (Exit) Exam: (See your instructor). Certificate students must complete this exam by the end of the 144th clock hour or 16th
week.

F. Critique Module 2413-05 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).