I. INTRODUCTION

A. This course provides the student with advanced concepts and skills required for tune-up and troubleshooting procedures of diesel engines. Emphasis on the science of diagnosis with a common sense approach.

B. Diesel Engine Testing and Repair I (DEMR 1410) is a required course for the completion of a two year Associate of Applied Science degree in Diesel Engine Mechanic and Repairer or Level I or Level II certificate of completion in the Diesel Technician Program.

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

D. Prerequisites: This course has prerequisites of DEMR 1401 and 1406 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, Basic Diesel Tune-Up and Troubleshooting, the student will:

A. Identify, inspect, test and measure and disable and reassemble engine parts. (C20)

B. Explain the methods and processes required to troubleshoot a Diesel Engine. (C7)

C. Explain diesel engine fuel system operating principles. (C7)

D. Troubleshoot and tune-up a diesel engine equipped with a distributor pump fuel system. (C20)

E. Troubleshoot and tune-up a Diesel Engine equipped with a pump-line-nozzle fuel system. (C20)

F. Troubleshoot and tune-up a diesel engine equipped with a Cummins PT Fuel System. (C20)
G. Troubleshoot and tune-up a diesel engine equipped with a Detroit Diesel Mechanical Unit Inspector fuel system. (C20)

H. Demonstrate decision making skills by selecting correct repair procedures. (C20)

I. Define terms that apply to diesel fuel. (C7)

J. Name the alternative fuels being considered in the Transportation Industry. (C20)

K. Identify fuel subsystem components of a Diesel Fuel System. (C7)

L. List and explain the objectives of the Diesel Fuel Injection System. (C7)

M. List and explain the operation of four types of fuel injection nozzles. (C7)

N. Explain the classifications and operation of a mechanical governor. (C7)

O. Use Technical Publications. (C18)

P. Use Test and Diagnostic Equipment. (C18)

Q. Practice Shop Safety. (C19)

R. Negotiate: Work toward agreements involving exchange of resources, resolve diverse interests. (C13)

III. INSTRUCTIONAL MATERIALS

A. Instructional materials for this course can 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 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 128 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, audiovisual 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, audiovisual 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 DVD, CD’s 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.

   All lab work will be completed on an individual basis. The student will receive a “pass” or “fail” 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.

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 a “N” for the course.

F. There will be eight (8) written examinations in this course (7 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" 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 into the instructor prior to starting performance exams for that module.
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

**Certificate Students:** 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").

**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.**

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

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

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

Grade Computations: (Example)

Written Exam Scores: (There will be 11 written exams)

<table>
<thead>
<tr>
<th>Exam</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>90</td>
</tr>
<tr>
<td>Exam 2</td>
<td>80</td>
</tr>
<tr>
<td>Exam 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 = B

VI. 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:

- 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 “N”, 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 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 “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 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.
VII. FIRST CLASS MEETING

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

B. The instructor will verify the enrollment form:

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
   8. Dress code
   9. Parking
   10. Sign-in computer
   11. Course outline/fact sheets/student handouts
   12. Hazardous communications/MSDS information
   13. Shop safety
VIII. COURSE OUTLINE OR SEQUENCE

1. Module 1410-01: Diesel and Alternative Fuels

A. Time:
   Certificate Students: 10 Clock hours
   Degree Students: 1 Week

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
   1. Define terms that apply to diesel fuel. (C7)
   2. Name the alternative fuels being considered in the transportation industry. (C7)

C. Read Chapter 17 in Resource 1401-04. (Textbook)

D. Read Chapter 27 in Resource 1401-04. (Textbook)

E. Read Fact Sheet 1410-01-01.

F. Read Fact Sheet 1410-01-02.

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. There are no audio-visuals for this module.

I. See your instructor and ask him if there is any other information that you should view or read that pertains to this module.

J. Complete the Learning Activities listed below for this module.
   1. Complete Worksheet 1410-01-01
   2. Complete Worksheet 1410-01-02
   3. Complete Worksheet 1410-01-03

K. Review for Module 1410-01 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

L. Module 1410-01 Written Exam: (See your instructor).

M. Critique Module 1410-01 Written Exam: (See your instructor)
N. Performance Exam 1410-01: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the performance exam for this module. (See your instructor).

O. 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 1st week.

II. Module 1330-02: Diesel Engine Components

A. Time:
Certificate Students: 10 clock hours
Degree Students: 1 week

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

1. Identify, inspect, test and measure, disassemble and reassemble engine parts. (C20)
2. Identify fuel subsystem components of a diesel fuel system. (C7)
3. List and explain the objectives of the diesel fuel injection system. (C7)
4. List and explain the operation of four types of fuel injection nozzles. (C7)
5. Explain the classification and operations of a mechanical governor. (C7)
6. Use technical publications. (C18)
7. Use test and diagnostic equipment. (C18)
8. Practice shop safety. (C19)

C. Read Chapter 18 in Resource DEMR 1401-04. (Textbook)

D. Read Chapter 19 in Resource DEMR 1401-04. (Textbook)

E. Read Chapter 20 in Resource DEMR 1401-04. (Textbook)

F. Read Chapter 26 in Resource DEMR 1401-04. (Textbook)

G. Read Fact Sheet 1410-02-01.

H. Read Fact Sheet 1410-02-02

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

J. View Audio-Visuals.
   1. View Resource DEMR 1410-01 on “Diesel Injection System Service”.

K. See your instructor and ask him if there is any other information that you should read or view that pertains to this module.
L. Complete the learning activities listed below for this module.
   1. Complete Worksheet 1410-02-01
   2. Complete Worksheet 1410-02-02
   3. Complete Worksheet 1410-02-03
   4. Complete Worksheet 1410-02-04
   5. Complete Worksheet 1410-02-05

M. Review for Module 1410-02 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 1410-02 Written Exam: (See your instructor)

O. Critique Module 1410-02 Written Exam. (See your Instructor)

P. Performance Exam Module 1410-02. Refer to the Laboratory Learning Activities (lab sheet) in this module book and complete the performance exam for this module. (See your instructor)

Q. Degree students must complete this module by the need of the 2nd week. Certificate students must complete this module by the end of the 20th clock hour.

III. Module 1410-03: Diesel Engine Troubleshooting

A. Time:
   Certificate Students: 10 clock hours
   Degree Students: 2 weeks

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
   1. Explain the methods and processes required to troubleshoot a diesel engine. (C7)

C. Read Chapter 48 Resource 1410-04. (Textbook)

D. Read Fact Sheet 1410-03-01.

E. Read Fact Sheet 1410-03-02.

F. See your instructor and ask him to explain any part of the reading assignment that you do not understand.
G. View Audio Visuals: (See your Instructor)
   1. View Resource 1410-03 on Troubleshooting Engine Vibration
   2. View Resource 1410-04 on the Harmonic Balancer
   3. View Resource 1406-09 on Troubleshooting the Air System
   4. View Resource 1406-10 on Troubleshooting Engine Exhaust Smoke

H. See your instructor and ask him if there is any other information that should be
   viewed or read that pertains to this module.

I. Complete the Learning Activities listed below for this module.
   1. Complete Worksheet 1410-03-01
   2. Complete Worksheet 1410-03-02

J. Review for Module 1410-03 Written Exam: Study all previous assignments in this
   module. See your instructor and ask him to explain any area that you do not
   understand.

K. Module 1410-03 Written Exam: (See your Instructor).

L. Critique Module 1410-03 Written Exam: (See your Instructor)

M. Performance Exam Module 1410-02: Refer to the Laboratory Learning Activities
   (Lab Sheet) in this module book and complete the Performance exam for this
   module. (See your Instructor)

N. Degree students must complete this module by the end of the 4th week. Certificate
   students must complete this module by the end of the 35th clock hour.

IV. Module 1410-04: Diesel Engine Troubleshooting and Tune-Up: Distributor Pump Fuel Systems

A. Time:
   Certificate Students: 25 Clock Hours
   Degree Students: 3 weeks

B. Module Learning Outcomes: Upon satisfactory completion of this module the
   student will:
   1. Identify, inspect, test and measure and disassemble and reassemble engine
      parts. (C20)
   2. Troubleshoot and tune-up a diesel engine equipped with a distributor
      pump system. (C20)
3. Demonstrate decision making skills by selecting correct repair procedures. (C20)
4. Use technical publications. (C18)
5. Use test and diagnostic equipment. (C18)
6. Practice shop safety. (C19)

C. Read Chapter 25 in Resource DEMR 1401-04 (Textbook)

D. Read Fact Sheet 1410-04-01

E. Read Fact Sheet 1410-04-02

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

G. View Audio-Visuals: (See your Instructor)
   1. View Resource 1410-02 on the 6.2 liter diesel engine explained.
   2. View Resource 1410-05 on Distributor Pump Troubleshooting and Repair

H. See your instructor and ask him is there is any other information that should be viewed or read that pertains to this module.

I. Complete the Learning Activities listed below for this module.
   1. Complete Worksheet 1410-04-01
   2. Complete Worksheet 1410-04-02

J. Review for Module 1410-04 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

K. Module 1410-04 Written Exam: (See your Instructor)

L. Critique Module 1410-04 Written Exam: (See your Instructor)

M. Performance Exam Module 1410-04: Refer to the Laboratory Learning Activities (Lab Sheet) in this module and complete the Performance exam for this module. (See your instructor)

N. Degree students must complete this module by the end of the 7th week. Certificate students must complete this module by the end of the 60th clock hour.

A. Time:
Certificate Students: 25 clock hours
Degree Students: 3 weeks

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

1. Identify, inspect, test and measure and disassemble and reassemble engine parts. (C20)
2. Troubleshoot and tune-up Cummins “B” and “C” series engines equipped with pump-line-nozzle fuel system. (C20)
3. Demonstrate decision making skills by selecting correct repair procedures. (C20)
4. Use technical publications. (C18)
5. Use test and diagnostic equipment. (C18)
6. Practice shop safety. (C19)

C. Read Chapter 21 in Resource DEMR 1401-04 (Textbook)

D. Read Fact Sheet 1410-05-01.

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

F. View Audio-Visuels: (See your instructor)
   2. View Resource 1410-07 on In-Line Fuel Pump spill port timing.

G. See your instructor and ask him if there is any other information that should be read or viewed that pertains to this module.

H. Complete the Learning Activities listed below for this module.
   1. Complete Work Sheet 1410-05-01
   2. Complete Work Sheet 1410-05-02

I. Review for Module 1410-06 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 1410-05 Written Exam: (See your Instructor)

K. Critique Module 1410-05 Written Exam: (See your Instructor)
L. Module 1410-05: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Degree students must complete this module by the end of the 10th week. Certificate students must complete this module by the end of the 85th clock hour.

VI. Module 1410-06: Diesel Engine Troubleshooting and Tune-Up – Cummins PT Fuel System

A. Time:
   Certificate Students: 20 clock hours
   Degree Students: 3 weeks

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

1. Identify, inspect, test and measure and disassemble and reassemble engine parts. (C20)
2. Troubleshoot and tune-up and engine equipped with a Cummins PT Fuel System.
3. Use technical publications. (C18)
4. Use service publications. (C18)
5. Practice shop safety. (C19)

C. Read Chapter 24 in Resource DEMR 1401-04. (Textbook)

D. Read Fact Sheet 1410-06-01 on PT injector. (Top Spot)

E. Read Fact Sheet 1410-06-02 on Valve and Injector Adjustment.

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

G. View Audio-Visuals:
   1. View Resource 1410-20 on Step Timing Control
   2. View Resource 1410-11 on Injector and Valve Adjustment
   3. View Resource 1410-12 on STC Overhaul Adjustments

H. See your instructor and ask him if there is any other information that should be viewed or read that pertains to this module.

I. Complete the Learning Activities listed below for this module.
   1. Complete Worksheet 1410-0601
J. Review for module 1410-06 Written Exam. Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

K. Module 1410-06 Written Exam: (See your instructor)

L. Critique Module 1410-06 Written Exam: (See your instructor)

M. Performance Exam Module 1410-06: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

N. Degree students must complete this module by the end of the 13th week. Certificate students must complete this module by the end of the 105th clock hour.

VII. **Module 1410-07: Diesel Engine Troubleshooting and Tune-up – Detroit Diesel Mechanical Unit Injector System**

A. Time
   - Certificate Students: 20 clock hours
   - Degree Students: 2 weeks

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

   1. Troubleshoot and tune-up an engine equipped with a Detroit Diesel Mechanical fuel system. (C20)
   2. Identify, inspect, test and measure and disassemble and reassemble engine parts. (C20)
   3. Negotiate: work toward agreements involving change of resources, resource diverse interests. (C20)
   4. Use test and diagnostic equipment. (C18)
   5. Use technical publications. (C18)

C. Read Chapter 22 in Resource DEMR 1401-04. (Textbook)

D. Read section 2 and 2.1.1 pgs. 1-4 in the DDC V-71 Engine Manual. (See your instructor)

E. Read Fact Sheet 1410-07-01.

F. Read Fact Sheet 1410-07-02.

G. Read Fact Sheet 1410-07-03.
See your instructor and ask him is there is any other information that pertains to this module.

View Audio-Visuals:
1. View Resource DEMR 1410-08 on Troubleshooting and Tune-up.
2. View Resource DEMR 1410-09 on Tune-up Limiting Speed Governor.

See your instructor and ask him if there is any other information that pertains to this module.

Complete the Learning Activities listed below for this module.
1. Complete Worksheet 1410-07-01
2. Complete Worksheet 1410-07-02
3. Complete Worksheet 1410-07-03

Review Exam Module 1410-07: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

Module 1410-07 Written Exam: (See your Instructor)

Critique Module 1410-07 Written Exam: (See your Instructor)

Performance Exam Module 1410-07: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your Instructor)

Degree students must complete this module by the end of the 15th week. Certificate students must complete this module by the end of the 125th clock hour.

**VIII. Module 1410-08: Exit Exam**

A. Time
   Certificate Students: 3 clock hours
   Degree Students: 1 week

B. Module Learning Outcomes: Upon completion of this module the student will:
   1. Complete the Exit Exam

C. Review all previous assignments in this module.

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

E. Module 1410-08 written (Exit) exam: (See your instructor)
F. Critique module 1410-08 written (Exit) exam (See your instructor)

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

H. Certificate students should complete this module by the end of the 128th clock hour. Degree students should complete this module by the end of the 16th week.