I. INTRODUCTION

A. This course provides the student with a knowledge of the basic principles of operation, troubleshooting, and repair of standard transmissions, drive shafts and axle assemblies.

B. Power Trains I (DEMR 1321) is a required course for the completion of a two year Associate of Applied Science degree in Diesel Engine Mechanic and Repairer or a 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 a prerequisite or co-requisite (A.A.S. Degree) of DEMR 1401 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, Power Trains I, the student will:

A. Locate, Identify and explain the function of components of a heavy-duty standard power train. (C7)

B. Name and explain the application and operating principles if the various types of clutches used in heavy-duty power trains. (C7)

C. Identify and explain the function of components of disc-type engine clutches and clutch brakes. (C7)

D. Adjust, diagnose, remove, disassemble, inspect, repair and install clutches. (C20)

E. Use mathematical operations to define gear ratios and torque multiplication. (F4)

F. Identify the different types and explain the function of heavy-duty standard transmissions. (C20)

G. Diagnose, Disassemble, repair and reassemble a heavy-duty standard transmission. (C20)

H. Identify and explain the function of the components of a drive line. (C7)
I. Diagnose, disassemble, repair and reassemble a drive line. (C20)
J. Identify and explain the function of rear axle assemblies and differential carriers. (C7)
K. Identify the components and explain the operating principles, types and applications of interaxle differentials and traction equalizers. (C7)
L. Inspect, diagnose, disassemble, repair and reassemble a differential carrier. (C20)
M. Perform visual inspection of components. (C20)
N. Determine serviceability of components. (C20)
O. Demonstrate knowledge of power train fundamentals. (C19)
P. Use tools and equipment. (C18)
Q. Use service publications. (C18)
R. Practice shop safety. (C19)
S. Creative thinking: Generates new ideas. (F7)

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 144 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 DVD’s, 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. 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.

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 (Enabling tasks, 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
COURSE OUTLINE OR SEQUENCE

I. Module 1421-01: Power Train Components

A. Time:
   Certificate Student: 4 Clock Hours
   Degree Student: 1 Week

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
   1. Locate and identify and explain the function of the components of a heavy-duty power train. (C7)
   2. Demonstrate knowledge of power train fundamentals. (C19)
   3. Creative thinking: Generate new ideas. (F7)

C. Read Fact Sheet 1421-01-01.

D. Read Fact Sheet 1421-01-02.

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

F. View Audio Visuals: (See your instructor)
   There are currently no audio visuals for this module.

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

H. Complete the Learning activities listed below this module.
   1. Complete Worksheet 1421-01-01
   2. Complete Worksheet 1421-01-02

I. Review for Module 1421-01 Written Exam. Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 1421-01 Written Exam: (See your instructor)

K. Critique Module 1421-01 Written Exam: (See your instructor)

L. Performance Exam Module 1421-01: 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 must complete this module by the end of the 4th clock hour.
Degree students must complete this module by the end of the 1st week.
II. Module 1421-02: Clutch Systems

A. Time:
Certificate Student: 6 Clock Hours
Degree Student: 1 Week

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
   1. Demonstrate knowledge of power train fundamentals. (C19)
   2. Name and explain the application and operating principles of the various types of clutches used in heavy-duty power train. (C7)

C. Read chapter 14, pgs 386 thru 395 in Resource DEMR 1421-01 (Text Book)

D. Read Fact Sheet 1421-02-01.

E. Read Fact Sheet 1421-02-02.

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) Student must take notes.
   1. View audio visuals as required in the Laboratory Learning Activities (Lab Sheet).

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 1421-02-01
   2. Complete Worksheet 1421-02-02
   3. Complete Worksheet 1421-02-03

J. Review for module 1421-02 Written Exam. Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

K. Module 1421-02 Written Exam: (See your instructor)

L. Critique Module 1421-02 Written Exam: (See your instructor)

M. Performance Exam Module 1421-02: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance Exam for this
module. (See your instructor)

N. Certificate students must complete this module by the end of the 19th clock hour. Degree students must complete this module by the end of the 1st week.
III. Module 1421-03: Disc Type Clutches and Clutch Brakes

A. Time:
Certificate Students: 6 Clock Hours
Degree Students: 1 Week

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
1. Demonstrate knowledge of power train fundamentals. (C19)
2. Identify and explain the function of the components of disc-type clutches and clutch brakes. (C7)

C. Read Chapter 14 pgs. 392 thru 399 in Resource DEMR 1421-01. (Textbook)

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

E. View Audio Visuels: (See your instructor) Student must take notes.

1. View Resource DEMR 1421-04 on “The Right Clutch For Every Truck”.
2. View Resource DEMR 1421-05 on “Spicer Clutch Operations”.

F. Complete Fact Sheet 1421-03-01.

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

H. Complete the Learning Activities listed below for this module:
1. Complete Worksheet 1421-03-01.

I. Review for Module 1421-03 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 1421-03 Written Exam: (See your instructor)

K. Critique Module 1421-03 Written Exam: (See your instructor)

L. Performance Exam Module 1421-03: 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 must complete this module by the end of the 16th clock hour. Degree students must complete this module by the end of the 2nd week.
IV. Module 1421-04: Clutch Repair

A. Time:
Certificate Student: 15 Clock Hours
Degree Student: 2 Weeks

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

1. Adjust, diagnose, remove, disassemble, inspect, repair and reinstall clutches. (C20)
2. Perform visual inspection of components. (C20)
3. Determine serviceability of components. (C20)
4. Use tools and equipment. (C18)
5. Use service publications. (C18)
6. Practice shop safety. (C19)

C. Read Chapter 14 pgs. 399 thru 413 (Troubleshooting) in Resource DEMR 1421-01. (Textbook)

D. Read chapter 14 pgs 414 thru 431 in Resource DEMR 1421-01 (Text Book).

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) Student must take notes.

1. View Resource DEMR 1421-06 on “Spicer System Maintenance”
2. View Resource DEMR 1421-06 on “Clutch Drive Pin Tips.”
3. View Resource DEMR 1421-06 on “Spicer Medium Duty Clutch Failure Analysis.”
4. View Resource DEMR 1421-06 on “Spicer Clutch Installing and Adjusting.”

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

H. Complete the Learning Activities listed below for this module:
1. Complete Worksheet 1421-04-01
2. Complete Worksheet 1421-04-02

I. Review for Module 1421-04 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 1421-04 Written Exam: (See your instructor).
K. Critique Module 1421-04 Written Exam: (See your instructor).

L. Performance Exam Module 1421-04: 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 must complete this module by the end of the 31st clock hour. Degree students must complete this module by the end of the 4th week.

V. Module 1421-05: Gears, Gear Ratios and Torque Multiplication

A. Time:
Certificate Student: 6 Clock Hours
Degree Student: 1 Week

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
1. Use mathematical operations to define gear ratios and torque multiplication. (F4)
2. Demonstrate knowledge of power train fundamentals. (C19)

C. Read Chapter 15 pgs. 434 thru 442 in Resource DEMR 1421-01. (Textbook)

D. Read Fact sheet 1421-05-01.

E. Complete Fact Sheet 1421-05-02.

F. Complete Fact Sheet 1421-05-03

G. View Auto-Visuals: (See your instructor)

There are currently no audio-visuals for this module.

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

J. Complete the Learning Activities listed below for this module:

K. Review for Module 1421-05 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 1421-05 Written Exam: (See your instructor)

M. Critique Module 1421-05 Written Exam: (See your instructor)

N. Performance Exam Module 1421-05: 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 must complete this module by the end of the 37th clock hour. Degree students must complete this module by the end of the 4th week.
VI. Module 1421-06: Heavy-Duty Standard Transmission Operation

A. Time:
Certificate Student: 8 Clock Hours
Degree Student: 1 Week

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
1. Identify the different types and explain the function of heavy-duty standard power train. (C7)
2. Demonstrate knowledge of power train fundamentals. (C19)

C. Read Chapter 15 pgs. 443 thru 474 (“Gear Train Configurations”) in Resource DEMR 1421-01. (Textbook)

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

E. View Audio-Visuals: (See your instructor) **Student must take notes.**
   2. View Resource DEMR 1421-12 on “What is a PTO.”

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

G. Complete the Learning Activities listed below for this module.
   1. Complete Worksheet 1421-06-01.
   2. Complete Worksheet 1421-06-02.

H. Review for Module 1421-06 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

I. Module 1421-06 Written Exam: (See your instructor)

J. Critique Module 1421-06 Written Exam: (See your instructor).

K. Performance Exam Module 1421-06: 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 must complete this module by the end of the 45th clock hour. Degree students must complete this module by the end of the 5th week.
VII. Module 1421-07: Heavy-Duty Transmission Troubleshooting and Repair

A. Time
Certificate Student: 48 Clock Hours
Degree Student: 4 Weeks

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
1. Diagnose, disassemble, repair and reassemble heavy-duty standard transmissions. (C20)
2. Perform visual inspections of components. (C20)
3. Determine serviceability of components. (C20)
4. Use tools and equipment. (C18)
5. Practice shop safety. (C19)

C. Read Chapter 16 in Resource DEMR 1421-01. (Textbook)

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 you instructor) Student must take notes.
2. View Resource DEMR 1421-14 on “Understanding Spur Gear Life.”
3. View Resource DEMR 1421-15 on “Parts Inspection.”
4. View Resource DEMR 1421-16 on “PM Means Economy.”
5. View Resource DEMR 1421-17 on “PTO Trouble-Shooting.”

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

G. Complete the Learning Activities listed below for this module.
2. Complete Worksheet 1421-07-02.

H. Review for Module 1421-07 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

I. Module 1421-07 Written Exam: (See your instructor)
J. Critique Module 1421-07 (Exit) Exam: (See your instructor)

K. Performance Exam Module 1421-07: 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 93rd clock hour. Degree students should complete this module by the end of the 10th week.
VIII. Module 1421-08: Drive Shaft and Universal Joint Function and Repair

A. Time:
Certificate Student: 12 Clock Hours
Degree Student: 1 Week

B. Module Learning Outcomes: Upon satisfactory completion of this module the student will:
1. Identify and explain the function of the components of a drive line. (C7)
2. Diagnose, disassemble, repair and reassemble a drive line. (C20)
3. Perform visual inspection of components. (C20)
4. Determine serviceability of components. (C20)
5. Demonstrate knowledge of power train fundamentals. (C18)
6. Use tools and equipment. (C18)
7. Practice shop safety. (C19)
8. Use service publications. (C18)

C. Read Chapter 22 in Resource DEMR 1421-01. (Textbook)

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

E. View Audio-Visuals: (See your instructor) **Student must take notes.**

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

G. Complete the Learning Activities listed below for this module.
   1. Complete Worksheet 1421-08-01.
   2. Complete Worksheet 1421-08-02.

H. Review for Module 1421-08 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

I. Module 1421-08 Written Exam: (See your instructor)

J. Critique Module 1421-08 Written Exam: (See your instructor).

K. Performance Exam Module 1421-08: 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 must complete this module by the end of the 105th clock hour. Degree students must complete this module by the end of the 11th week.