

DOCUMENT RESUME

ED 397 318

CE 072 203

TITLE Mississippi Curriculum Framework for Diesel Equipment Repair & Service (Program CIP: 47.0605--Diesel Engine Mechanic & Repairer). Secondary Programs.

INSTITUTION Mississippi Research and Curriculum Unit for Vocational and Technical Education, State College.

SPONS AGENCY Mississippi State Dept. of Education, Jackson. Office of Vocational and Technical Education.

PUB DATE 1, Aug 95

NOTE 71p.; For related documents, see CE 072 162-231.

PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC03 Plus Postage.

DESCRIPTORS Academic Education; Auto Mechanics; Behavioral Objectives; Classroom Techniques; Competence; *Competency Based Education; Core Curriculum; *Diesel Engines; Educational Equipment; Employment Qualifications; Hand Tools; Leadership; Motor Vehicles; Repair; Secondary Education; *Small Engine Mechanics; State Curriculum Guides; Statewide Planning; Student Evaluation

IDENTIFIERS Mississippi

ABSTRACT

This document, which reflects Mississippi's statutory requirement that instructional programs be based on core curricula and performance-based assessment, contains outlines of the instructional units required in local instructional management plans and daily lesson plans for diesel engine mechanics I and II. Presented first are a program description and course outlines. Section I contains curriculum frameworks for both courses, and section II contains outlines of the instructional units required in each course. Diesel Engine Mechanics I contains the following five units: orientation and safety; (2) tools, technical references, measurement, and fasteners; (3) basic engine operation principles; (4) basic electrical service; and (5) basic vehicle service. Diesel Engine Mechanics II contains these six units: (1) orientation and safety; (2) diesel engine rebuilding; (3) engine performance; (4) electrical systems; (5) hydraulics; and (6) power trains. Each unit includes suggested time on tasks, competencies and objectives, teaching strategies, assessment strategies, and resources. Recommended tools and equipment are listed in section III. Appended are lists of related academic topics and workplace skills for the 21st century and student competency profiles for both courses.

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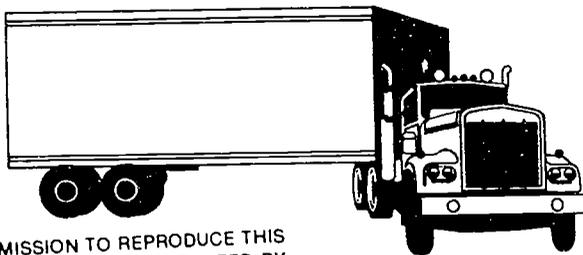
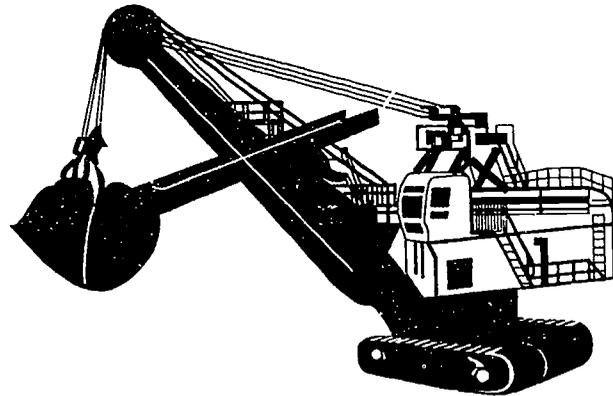
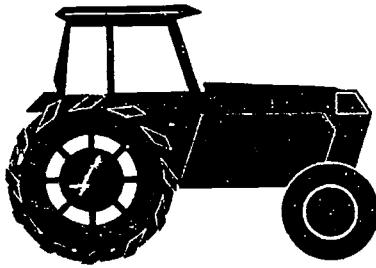
Mississippi Curriculum

Framework for

Diesel Equipment Repair and Service

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August 1, 1995

**MISSISSIPPI
CURRICULUM FRAMEWORK
FOR
DIESEL EQUIPMENT REPAIR & SERVICE
(PROGRAM CIP: 47.0605 - DIESEL ENGINE MECHANIC & REPAIRER)**

SECONDARY PROGRAMS

1995

August 1, 1995

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Published by the:

**Office of Vocational and Technical
Education
Mississippi Department of Education
Jackson, Mississippi**

**Research and Curriculum Unit for
Vocational and Technical Education
College of Education
Mississippi State University
Mississippi State, Mississippi**

1995

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FOREWORD

The courses in this document reflect the following statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended:

The State Department of Education shall provide an instructional program and establish guidelines and procedures for managing such programs in the public schools as part of the State Program of Educational Accountability and Assessment of Performance. . .

The department shall provide that such program or guidelines . . . are enforced through the performance-based accreditation system.

The local school board must adopt the objectives that will form the core curriculum that will be systematically delivered throughout the district.

Standards for student performance must be established for each core objective in the local program and those standards establish the district's definition of mastery for each objective.

There shall be an annual review of student performance in the instructional program against locally established standards.

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - The number of days of instruction that should be required to teach the competencies and objectives of the unit. For secondary occupational programs, a "day" represents a two-period block of instruction.
- Competencies and Suggested Objectives
 - A **Competency** represents a general concept of performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies in the curriculum framework.
 - The **Suggested Objectives** represent the enabling and supporting knowledge and performances that will indicate mastery of the competency.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each suggested objective. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.

- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include classroom discussions, laboratory exercises, and student assignments. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.
- Suggested Resources - This section indicates some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

The following guidelines were used in developing the curriculum framework in this document and should be considered in developing local instructional management plans and daily lesson plans:

- The content of the courses in this document reflects approximately 75 percent of the time allocated to each course. For a one-year course, this means that the content of the existing units of instruction should represent approximately 135 days of instruction. The remaining 25 percent of each course should be developed at the local district level and may reflect:
 - Additional units of instruction within the course related to topics not found in the state framework.
 - Activities which develop a higher level of mastery on the existing competencies and suggested objectives.
 - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised.
 - Activities which implement components of the Mississippi Tech Prep Initiative, including integration of academic and vocational-technical skills and coursework, school-to-work transition activities, and articulation of secondary and postsecondary vocational-technical programs.
 - Individualized learning activities, including work site learning activities, to better prepare individuals in the courses for their chosen occupational area.

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- Sequencing of the units of instruction within a course is left to the discretion of the local district. Naturally, foundation units related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other units related to specific skill areas in the course, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

ACKNOWLEDGEMENTS

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PROGRAM DESCRIPTION

DIESEL ENGINE MECHANIC AND REPAIRER

(PROGRAM CIP: 47.0605)

Diesel Engine Mechanic and Repairer is a two-year instructional program that provides students with a foundation of skills and knowledge related to the service and repair of diesel vehicles and power equipment. Students who complete the program may enter employment in an entry level position, or continue their education in a postsecondary technical program such as diesel technology, heavy equipment maintenance, and other related areas. Students receive instruction in the maintenance and service of a variety of vehicles including small equipment, automobiles, trucks, and tractors/construction equipment. The program consists of two courses, each nine months in length. Each course must be taught in a minimum two-class-period block (500 class minutes per week). The first course in the program includes instruction in the foundation skills related to safety, tool and equipment usage, measurement, basic vehicle service, and electrical system service. The second course in the program provides students with foundation skills related to diesel engine performance, power trains, diesel engine rebuilding, electrical systems, and hydraulic service.

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COURSE OUTLINE

DIESEL ENGINE MECHANICS I

<u>Unit #</u>	<u>Title</u>	<u>No. of Days</u>
Unit 1	Orientation and Safety	5
Unit 2	Tools, Technical References, Measurement & Fasteners	25
Unit 3	Basic Engine Operation Principles	60
Unit 4	Basic Electrical Systems	25
Unit 5	Basic Service	20

DIESEL ENGINE MECHANICS II

<u>Unit #</u>	<u>Title</u>	<u>No. of Days</u>
Unit 1	Orientation and Safety	5
Unit 2	Diesel Engine Rebuilding	40
Unit 3	Engine Performance	35
Unit 4	Electrical Systems	35
Unit 5	Hydraulics	10
Unit 6	Power Trains	10

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SECTION I:
CURRICULUM FRAMEWORK
FOR
DIESEL ENGINE MECHANIC AND REPAIRER

CURRICULUM FRAMEWORK

Course Name: Diesel Engine Mechanics I

Course CIP Code: 47.0605

Course Description: Diesel Engine Mechanic I is the entry level course of the secondary Diesel Engine Mechanic program. Students in Diesel Engine Mechanics I will gain foundation competencies related to safety, tool and equipment usage, measurement, basic engine service, and brake and electrical system service. (2-2½ Carnegie units, depending upon time spent in the course.)

Competencies and Suggested Objectives:

1. Review occupational and leadership opportunities in Diesel Equipment Repair and Service.
 - a. Investigate occupational opportunities in the local area.
 - b. Update the student's Career/Educational Plan.
 - c. Describe leadership opportunities from student youth organizations in the school and community, including VICA.

Related Academic Topics (See Appendix A):

C1, C4, C6

Workplace Skills (See Appendix B):

WP2, WP3, WP6

2. Demonstrate safety procedures used in vehicle service.
 - a. Apply safety rules for personal and general shop conduct, and the use of safety color coding in vehicle shops.
 - b. Apply general safety rules for tools and shop equipment including use of hand tools, air and electric power tools, and other shop equipment.
 - c. Apply general safety rules associated with working on various vehicle systems.
 - d. Apply rules and procedures for handling, storing, and disposing of hazardous materials.

Related Academic Topics (See Appendix A):

C2, C4

S5, S6, S8

Workplace Skills (See Appendix B):

WP5

3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.
 - a. Recognize procedures for handling, storing, and disposing of hazardous materials.
 - b. Describe methods for reducing hazardous waste.
 - c. Describe procedures for storing hazardous waste.

- d. Interpret data found on a hazardous materials safety data sheet.
- e. Describe general safety procedures to follow for first aid and cleanup, in case of an accident involving hazardous materials.
- f. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Related Academic Topics (See Appendix A):

*C1, C2, C4
S5, S8*

- 4. Demonstrate proper use and storage of tools and equipment in a vehicle shop.
 - a. Identify and demonstrate the proper use of common hand tools including wrenches, sockets, pliers, screwdrivers, etc. (See Section II of this document.)
 - b. Identify and demonstrate the proper use of lifting and hoisting equipment (See Section II of this document.)
 - c. Identify and demonstrate the proper use of cleaning equipment (See Section II of this document.)
 - d. Identify and demonstrate the proper use of power equipment including impact wrenches, drills, grinders, and presses. (See Section II of this document.)
 - e. Organize and maintain a systematic storage system for hand and power tools.

Related Academic Topics (See Appendix A):

C1, C3, C4

Workplace Skills (See Appendix B):

WP4, WP5

- 5. Locate and apply service specifications and information.
 - a. Locate service specifications and information.
 - b. Interpret and apply information to a specific job on a specific vehicle.
 - c. Locate and interpret vehicle and major component identification numbers (VIN, certification, and calibration levels).

Related Academic Topics (See Appendix A):

C1, C2

Workplace Skills (See Appendix B):

WP2, WP5

- 6. Demonstrate measurement practices used in vehicle service.
 - a. Measure the length of an object using a rule to the nearest 1/16th of an inch and 1 millimeter.
 - b. Measure the inside diameter, outside diameter, and/or depth to the nearest .001 of an inch and nearest .1 millimeter, using precision measuring instruments (micrometer, calipers, and dial indicators).

Related Academic Topics (See Appendix A):

C1, C4

Workplace Skills (See Appendix B):

WP2, WP6

7. Identify common fasteners and describe their use.
 - a. Identify the different types of bolts, nuts, and washers; and describe their appropriate uses.
 - b. Identify bolts by grade, diameter, length, and thread pitch.
 - c. Identify different glues and sealants used in vehicle service, and describe their appropriate use.
 - d. Restore internal and external threads.

Related Academic Topics (See Appendix A):

C1, C4

Workplace Skills (See Appendix B):

WP1, WP2, WP5

8. Describe the basic operation principles of a diesel engine.
 - a. Identify the major parts in a diesel engine.
 - b. Describe the process of combustion in a diesel engine.
 - c. Describe the sequence of operation of a four-stroke cycle diesel engine.
 - d. Identify the sequence of operation of a two-stroke cycle diesel engine.
 - e. Differentiate between a two-stroke and four-stroke cycle diesel engine.
 - f. State differences in diesel and gasoline engines.
 - g. List basic requirements of diesel fuel system.
 - h. Perform overhead adjustments on two- and four-stroke diesel engines.

Related Academic Topics (See Appendix A):

C1, C3, C6

Workplace Skills (See Appendix B):

WP2, WP5, WP6

9. Apply basic electrical principles as they relate to vehicle circuits.
 - a. Describe the flow of electricity in a simple circuit including voltage, amperage, and resistance.
 - b. Demonstrate the use of electrical test instruments including multimeters and continuity testers to measure voltage, amperage, and resistance.
 - c. Interpret wiring diagrams for a given vehicle circuit, including tracing the flow of electricity in the circuit and identifying electrical symbols in the diagram.
 - d. Construct a simple DC circuit and test for power and continuity.
 - e. Diagnose an electrical circuit (horn, turn signal, etc.) for power; repair as needed.

Related Academic Topics (See Appendix A):

C2, C4, C5

Workplace Skills (See Appendix B):

WP2, WP5, WP6

10. Perform basic charging and starting system service.
 - a. Start a vehicle using jumper cables or auxiliary power supply.
 - b. Perform battery capacity (load, high rate discharge) test and determine needed repairs, including slow/fast battery charge.
 - c. Remove and replace a battery.

- d. Perform a starter draw test and a starter voltage drop test and determine needed repairs.
- e. Diagnose charging system problems that cause undercharge, overcharge, or no charge condition.
- f. Remove and replace an alternator.
- g. Remove and replace a starter.

Related Academic Topics (See Appendix A):

C1, C3, C4

Workplace Skills (See Appendix B):

WP1, WP4, WP6

- 11. Identify and describe the major systems and components of a vehicle.
 - a. Identify the major components. Describe their purpose/function of the following systems:
 - 1) Power trains
 - 2) Chassis, steering, and suspension
 - 3) Fuel
 - 4) Electrical
 - 5) Cooling
 - 6) Exhaust

Related Academic Topics (See Appendix A):

C1, C5, C6

Workplace Skills (See Appendix B):

WP2, WP4, WP5

- 12. Perform lubrication maintenance and general inspection service.
 - a. Compare a work order and maintenance record for a given vehicle.
 - b. Visually inspect the engine lubrication system for leaks and determine needed repairs.
 - c. Select proper lubricants and filters for lubrication service.
 - d. Change engine oil and filter according to manufacturer's specifications and in accordance with disposal procedures.
 - e. Perform a chassis and body lubrication.
 - f. Inspect and service as needed other filters on a diesel engine including air, fuel, crankcase vent filters, etc.
 - g. Conduct a general preventive maintenance inspection of hoses and belts, fluid levels, wiper blades, headlights and accessory lights, tires, exhaust, shocks, etc.; repair/replace/adjust as needed.
 - h. Clean and service battery including case, cables, and connections; and check electrolyte level (if applicable). (Maintain electronic memory functions while cleaning.)
 - i. Discuss differences in servicing a diesel engine as compared to a gasoline engine, including replacing fuel filters and bleeding the diesel fuel system.

Related Academic Topics (See Appendix A):

C2, C3, C5

Workplace Skills (See Appendix B):

WP2, WP4, WP6

13. Perform cooling system maintenance.
 - a. Service an air-cooled engines cooling system.
 - b. Drain and refill a cooling system.
 - c. Inspect and pressure test a cooling system for proper operation; repair/replace thermostats, hoses, radiator caps, etc., as needed.

Related Academic Topics (See Appendix A):

C4, C5

Workplace Skills (See Appendix B):

WP1, WP5

14. Discuss the operation of brake systems used on heavy equipment and large trucks.
 - a. Discuss the operation of a mechanical brake system.
 - b. Discuss the operation of an air brake system.
 - c. Discuss the operation of a wet brake system.

Related Academic Topics (See Appendix A):

C5, C6

Workplace Skills (See Appendix B):

WP4, WP6

CURRICULUM FRAMEWORK

Course Name: Diesel Engine Mechanics II

Course CIP Code: 47.0609

Course Description: Diesel Engine Mechanic II is a continuing course in the secondary Diesel Engine Mechanic program. Students will gain advanced competencies in safety, leadership, engine rebuilding and performance, electrical systems, hydraulics, and power trains. (2-2½ Carnegie units, depending upon time spent in the course.)

Competencies and Suggested Objectives:

1. Review occupational and leadership opportunities in Diesel Equipment Repair and Service.
 - a. Investigate occupational opportunities in the local area.
 - b. Update the student's Career/Educational Plan.
 - c. Describe leadership opportunities available from student youth organizations in the school and community, including VICA.

Related Academic Topics (See Appendix A):

C1, C4, C6

Workplace Skills (See Appendix B):

WP2, WP3, WP6

2. Demonstrate safety procedures used in vehicle service.
 - a. Apply safety rules for personal and general shop safety including eye (State Eye Safety Law provisions), ear, and body protection, general rules of shop conduct, and the use of safety color coding in vehicle shops.
 - b. Apply general safety rules for tool and shop equipment use including use of hand tools, air and electrical power tools, and other shop equipment.
 - c. Apply general safety rules associated with working on various vehicle systems.
 - d. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of fire fighting devices.

Related Academic Topics (See Appendix A):

C2, C4

Workplace Skills (See Appendix B):

WP5

3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.
 - a. Recognize signal words and symbols that indicate severity of a hazard.
 - b. Describe methods for reducing hazardous waste.
 - c. Describe procedures for storing hazardous waste.

- d. Interpret data found on a hazardous material safety data sheet.
- e. Describe general safety procedures to follow for first aid and cleanup, in case of an accident involving hazardous materials.
- f. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Related Academic Topics (See Appendix A):

*C1, C2, C4
S5, S8*

Workplace Skills (See Appendix B):

WP2, WP3, WP4, WP5, WP6

- 4. Disassemble diesel engine and evaluate its components.
 - a. Perform diesel engine disassembly process by utilizing service manual instructions for disassembly.
 - b. Clean diesel engine parts and compile a list of the parts utilizing parts manual listing.
 - c. Evaluate diesel engine components utilizing service manual specifications.

Related Academic Topics (See Appendix A):

C1, C2, C4, C6

Workplace Skills (See Appendix B):

WP1, WP4, WP5

- 5. Reassemble diesel engine.
 - a. Perform diesel engine assembly process by utilizing service manual for assembly sequence.
 - b. Perform diesel engine tightening operations after locating diesel engine tightening specifications in service manual.
 - c. Perform proper diesel engine overhead adjustments according to service manual procedures.

Related Academic Topics (See Appendix A):

C3, C4, C5

Workplace Skills (See Appendix B):

WP1, WP4, WP5, WP6

- 6. Identify and relate auxiliary systems to engine performance including the following systems: lubrication, cooling, air induction, and exhaust.
 - a. Describe lubrication systems including flow, pressure regulation and bypass, oil properties, oil coolers, and filters; and list their effects on engine performance.
 - b. Describe liquid cooling system components including flow path, pump, radiator, hoses and belts, thermostats, and pressure caps. List their effects on engine performance.
 - c. Describe air induction including filter, turbo-chargers, blowers, and passages; and list their effects on engine performance.
 - d. Describe exhaust systems including manifold, mufflers, and exhaust outlets; and list their effects on engine performance.

Related Academic Topics (See Appendix A):

C4, C6

Workplace Skills (See Appendix B):

WP4, WP5, WP6

7. Identify and relate mechanical fuel systems to engine performance.
 - a. Discuss and locate components of diesel fuel systems.
 - b. Discuss distributor, scroll, and sleeve metering pumps.
 - c. Classify different fuel injection nozzles and calibrate nozzles according to manufacturer's specifications.
 - d. Classify different fuel unit injectors.
 - e. Classify different governors including mechanical, pneumatic, and hydraulic.

Related Academic Topics (See Appendix A):

C3, C5, C6

Workplace Skills (See Appendix B):

WP4, WP5, WP6

8. Apply basic electrical principles as they relate to vehicle circuits.
 - a. Identify safety practices for electrical systems.
 - b. Identify electronic systems components and state their function in a circuit including fixed and variable resistors, diodes, thermistors, and transducers.
 - c. Measure voltage, amperage, and resistance in electronic circuits utilizing a digital volt ohm meter and compare measurements to manufacturer's service specifications.
 - d. Differentiate among open, grounded, and short circuits.
 - e. Service and test the starting and charging systems components.

Related Academic Topics (See Appendix A):

C3, C4, C5

Workplace Skills (See Appendix B):

WP1, WP4, WP5, WP6

9. Perform basic service on a hydraulic system.
 - a. Discuss hazards and safety procedures for working with hydraulic systems.
 - b. Discuss the operation of a hydraulic system including components and their functions, and operating principles.
 - c. Compare the operation of a closed-center and open-centered hydraulic system.
 - d. Inspect a hydraulic system for leaks, and determine needed repairs.
 - e. Calculate force using pressure and area of various size cylinders.

Related Academic Topics (See Appendix A):

C3, C6

Workplace Skills (See Appendix B):

WP1, WP4, WP6

10. Perform basic driveline service/repair.
 - a. Inspect, diagnose and replace universal joints.
 - b. Remove and replace axle bearings and seals as needed.

c. Measure differential backlash using a dial indicator.

Related Academic Topics (See Appendix A):

C1, C3, C6

Workplace Skills (See Appendix B):

WP1, WP5, WP6

11. Perform clutch service.

a. Remove, inspect, make needed repairs, and reassemble a clutch assembly including flywheel, pressure plate, disc, and release assembly.

b. Adjust clutch linkage for free travel.

Related Academic Topics (See Appendix A):

C3, C6

Workplace Skills (See Appendix B):

WP1, WP4, WP6

12. Perform basic transmission service.

a. Service a transmission including changing fluid and checking fluid levels.

b. Visually inspect transmission including checking for leaks, and examining condition of fluid.

Related Academic Topics (See Appendix A):

C4, C6

Workplace Skills (See Appendix B):

WP5, WP6

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SECTION II:
CURRICULUM GUIDE
FOR
DIESEL ENGINE MECHANIC AND REPAIRER

August 1, 1995

DIESEL ENGINE MECHANICS I

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DIESEL ENGINE MECHANICS I
UNIT 1: ORIENTATION AND SAFETY

(5 days)

Competencies and Suggested Objectives:

1. Review occupational and leadership opportunities in Diesel Equipment Repair and Service.
 - a. Investigate occupational opportunities in the local area.
 - b. Update the student's Career/Educational Plan.
 - c. Describe leadership opportunities from student youth organizations in the school and community, including VICA.

Related Academic Topics (See Appendix A):

C1, C4, C6

Workplace Skills (See Appendix B):

WP2, WP3, WP6

2. Demonstrate safety procedures used in vehicle service.
 - a. Apply safety rules for personal and general shop conduct, and the use of safety color coding in vehicle shops.
 - b. Apply general safety rules for tools and shop equipment including use of hand tools, air and electric power tools, and other shop equipment.
 - c. Apply general safety rules associated with working on various vehicle systems.
 - d. Apply rules and procedures for handling, storing, and disposing of hazardous materials.

Related Academic Topics (See Appendix A):

C2, C4

S5, S6, S8

Workplace Skills (See Appendix B):

WP5

3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.
 - a. Recognize procedures for handling, storing, and disposing of hazardous materials.
 - b. Describe methods for reducing hazardous waste.
 - c. Describe procedures for storing hazardous waste.
 - d. Interpret data found on a hazardous materials safety data sheet.
 - e. Describe general safety procedures to follow for first aid and cleanup, in case of an accident involving hazardous materials.
 - f. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Related Academic Topics (See Appendix A):

C1, C2, C4

S5, S8

Workplace Skills (See Appendix B):

WP2, WP3, WP4, WP5, WP6

Suggested Teaching Strategies:

1. **Review occupational and leadership opportunities in Diesel Equipment Repair and Service.**
 - a. **Have students survey job opportunities through employer visits, resource person(s), telephone calls, help-wanted ads, or a field trip. Report their findings to the class.**
 - b. **Have student update his/her Career/Educational Plan to reflect accomplishments and plans for future educational and occupational activities.**
 - c. **Discuss leadership opportunities with the students, such as competitive events (VICA and Ford/AAA), award and degree programs, and committee work, that are provided through student youth organizations. Allow students to practice leadership in class and laboratory activities.**
2. **Demonstrate safety procedures used in vehicle service.**
 - a. **Provide students with reading material on safety rules related to personal safety and general shop safety.**
 - b. **Demonstrate the safety rules and procedures for using tools and shop equipment. Provide simulations to allow students to practice these rules. Monitor their use throughout the year.**
 - c. **Provide instruction to students on safety rules related to vehicle engines. Demonstrate the applications of these rules and provide simulations to allow students to practice them. Monitor students throughout the year on using these rules.**
 - d. **Invite the local fire department to give a demonstration of fire safety and the use of fire detection and fighting equipment. Identify fire safety equipment, its location, and its application(s) in the Diesel Equipment Repair & Service laboratory. Instruct students on its use.**
3. **Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.**
 - a. **Provide students with handouts or reading materials on the handling, storing, and disposing of hazardous materials. Discuss the use of signal words, and methods for reducing and storing hazardous waste.**
 - b. **Provide students with a copy of a hazardous materials safety data sheet (MSDS). Review and interpret the data found on the sheet with the class. Provide students with a second MSDS for their interpretation.**

- c. *Provide students with information (text or videotape) on first aid and clean-up procedures in case of a hazardous material accident. Discuss these procedures with the class. Allow students to practice these procedures through a simulation.*
- d. *Discuss and demonstrate with the students the procedures for handling, storing, and disposing of hazardous waste. Have students practice these procedures through a simulation. Monitor students for compliance with these procedures throughout the year.*

Suggested Assessment Strategies:

1. *Review occupational and leadership opportunities in Diesel Equipment Repair and Service.*
 - a. *Oral and/or written report on job opportunities.*
 - b. *Review of Career/Educational Plan update.*
 - c. *Participation in leadership activities in class or laboratory.*
2. *Demonstrate safety procedures used in vehicle service.*
 - a. *Test on safety procedures, equipment, and rules.*
 - b. *Monitor students to assure that compliance with safety procedures becomes an integral part of their work habits.*
3. *Describe procedures for handling, storing, and disposing of hazardous materials.*
 - a. *Test on hazardous materials, signal words, reducing and storing, MSD's, and safety/first aid procedures.*
 - b. *Student exercise - Hazardous material accident simulation.*
 - c. *Student exercise - Handling, storing, and disposing of hazardous materials.*
 - d. *Monitor students to assure that compliance with hazardous materials procedures becomes an integral part of their work habits.*

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1988.

DIESEL ENGINE MECHANICS I
UNIT 2: TOOLS, TECHNICAL REFERENCES, MEASUREMENT,
AND FASTENERS

(25 days)

Competencies and Suggested Objectives:

1. Demonstrate proper use and storage of tools and equipment in a vehicle shop.
 - a. Identify and demonstrate the proper use of common hand tools including wrenches, sockets, pliers, screwdrivers, etc. (See Section III of this document.)
 - b. Identify and demonstrate the proper use of lifting and hoisting equipment (See Section III of this document.)
 - c. Identify and demonstrate the proper use of cleaning equipment (See Section III of this document.)
 - d. Identify and demonstrate the proper use of power equipment including impact wrenches, drills, grinders, and presses. (See Section III of this document.)
 - e. Organize and maintain a systematic storage system for hand and power tools.

Related Academic Topics (See Appendix A):

C1, C3, C4

Workplace Skills (See Appendix B):

WP4, WP5

2. Locate and apply service specifications and information.
 - a. Locate service specifications and information.
 - b. Interpret and apply information to a specific job on a specific vehicle.
 - c. Locate and interpret vehicle and major component identification numbers (VIN, certification, and calibration levels).

Related Academic Topics (See Appendix A):

C1, C2

Workplace Skills (See Appendix B):

WP2, WP5

3. Demonstrate measurement practices used in vehicle service.
 - a. Measure the length of an object using a rule to the nearest 1/16th of an inch and 1 millimeter.
 - b. Measure inside diameter, outside diameter, and/or depth to the nearest .001 of an inch and nearest .1 millimeter, using precision measuring instruments (micrometer, calipers, and dial indicators).

Related Academic Topics (See Appendix A):

C1, C4

Workplace Skills (See Appendix B):

WP2, WP6

4. Identify common fasteners and describe their use.
 - a. Identify the different types of bolts, nuts, and washers; and describe their appropriate uses.
 - b. Identify bolts by grade, diameter, length, and thread pitch.
 - c. Identify different glues and sealants used in vehicle service, and describe their appropriate use.
 - d. Restore internal and external threads.

Related Academic Topics (See Appendix A):

C1, C4

Workplace Skills (See Appendix B):

WP1, WP2, WP5

Suggested Teaching Strategies:

1. *Demonstrate proper use and storage of tools and equipment in a vehicle shop.*
 - a. *Display tools and equipment to students. Describe and demonstrate their proper use. Have students perform simple jobs to demonstrate their proper use.*
2. *Locate and apply service specifications and information.*
 - a. *Provide students with a copy of a service manual (or computerized information system) and a given service job. Have them find the necessary information and give a report to the class or record in writing.*
3. *Demonstrate measurement practices used in vehicle service.*
 - a. *Identify measuring tools and instruments used in vehicle service. Demonstrate their use.*
 - b. *Have students practice measuring different objects to a given tolerance using each of the measuring instruments.*
4. *Identify common fasteners and describe their use.*
 - a. *Display and identify the different types, sizes, and styles of fasteners. Discuss their use and characteristics with the student.*
 - b. *Display different glues and sealants used in vehicle service. Discuss their characteristics and use.*
 - c. *Identify and demonstrate the use of tools used to restore internal and external threads. Have students select the correct tool for a given situation and practice using these tools.*

Suggested Assessment Strategies:

1. *Demonstrate proper use and storage of tools and equipment in a vehicle shop.*
 - a. *Test on tool identification.*
 - b. *Student exercise - Demonstrate the use of common hand tools.*
 - c. *Student exercise - Demonstrate the use of lifting and hoisting equipment.*
 - d. *Student exercise - Demonstrate the use of cleaning equipment.*

- e. *Student exercise - Demonstrate the use of power equipment.*
- f. *Student exercise - Organize and maintain a systematic storage system for hand and power tools.*
- 2. *Locate and apply service specifications and information.*
 - a. *Student exercise - Locate, interpret, and record service information for a specific job on a specific vehicle.*
- 3. *Demonstrate measurement practices used in vehicle service.*
 - a. *Student exercise - Measure length with a rule.*
 - b. *Student exercise - Measure inside and outside diameter and depth.*
- 4. *Identify common fasteners and describe their use.*
 - a. *Student exercise - Select the proper fastener.*
 - b. *Test - Select glues and sealants.*
 - c. *Student exercise - Restore internal and external threads.*

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1988.

DIESEL ENGINE MECHANICS I
UNIT 3: BASIC ENGINE OPERATION PRINCIPLES

(60 days)

Competencies and Suggested Objectives:

1. Describe the basic operation principles of a diesel engine.
 - a. Identify the major parts in a diesel engine.
 - b. Describe the process of combustion in a diesel engine.
 - c. Describe the sequence of operation of a four-stroke cycle diesel engine.
 - d. Identify the sequence of operation of a two-stroke cycle diesel engine.
 - e. Differentiate between a two-stroke and four-stroke cycle diesel engine.
 - f. State differences in diesel and gasoline engines.
 - g. List basic requirements of diesel fuel system.
 - h. Perform overhead adjustments on two- and four-stroke diesel engines.

Related Academic Topics (See Appendix A):

C1, C3, C6

Workplace Skills (See Appendix B):

WP2, WP5, WP6

Suggested Teaching Strategies:

1. *Describe the basic operation principles of a diesel engine.*
 - a. *Have students view videotape on engine components and complete engine components handout. Identify the different functions of each component.*
 - b. *Have student run compression check on a diesel engine and a gasoline engine. Compare and contrast the two by group discussion.*
 - c. *Have students view a videotape on the operation of a four-stroke cycle engine. Discuss the information and processes shown on this videotape.*
 - d. *Have students view a videotape on the operation of a two-stroke cycle engine. Discuss the information and processes shown in this videotape.*
 - e. *Discuss the operation of a diesel engine and a gasoline engine, including the major parts and components.*
 - f. *Develop a list of differences in the operation of a gasoline engine and a diesel engine.*
 - g. *Using diagrams, videotapes, or transparencies, have students list the different components and functions of a diesel fuel system. Demonstrate a diesel nozzle pop-test.*
 - h. *Discuss and demonstrate the procedures for overhead valve and injector plunger height adjustments according to manufacturer service procedures manual.*

Suggested Assessment Strategies:

1. *Describe the basic operation principles of a diesel engine.*
 - a. *Student exercise - Major parts of diesel engine.*
 - b. *Student exercise - Compression check.*
 - c. *Student exercise - Two-stroke and four-stroke cycle engines.*
 - d. *Test on comparison of different types of engines.*
 - e. *Student exercise - Diesel fuel system.*
 - f. *Student exercise - Diesel engine adjustments.*

Suggested References:

Test Book (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1988.

**DIESEL ENGINE MECHANICS I
UNIT 4: BASIC ELECTRICAL SERVICE**

(25 days)

Competencies and Suggested Objectives:

1. Apply basic electrical principles as they relate to vehicle circuits.
 - a. Describe the flow of electricity in a simple circuit including voltage, amperage, and resistance.
 - b. Demonstrate the use of electrical test instruments including multimeters and continuity testers to measure voltage, amperage, and resistance.
 - c. Interpret wiring diagrams for a given vehicle circuit, including tracing the flow of electricity in the circuit and identifying electrical symbols in the diagram.
 - d. Construct a simple DC circuit and test for power and continuity.
 - e. Diagnose an electrical circuit (horn, turn signal, etc.) for power; repair as needed.

Related Academic Topics (See Appendix A):

C2, C4, C5

Workplace Skills (See Appendix B):

WP2, WP5, WP6

2. Perform basic charging and starting system service.
 - a. Start a vehicle using jumper cables or auxiliary power supply.
 - b. Perform battery capacity (load, high rate discharge) test and determine needed repairs, including slow/fast battery charge.
 - c. Remove and replace a battery.
 - d. Perform a starter draw test and a starter voltage drop test and determine needed repairs.
 - e. Diagnose charging system problems that cause undercharge, overcharge, or no charge condition.
 - f. Remove and replace an alternator.
 - g. Remove and replace a starter.

Related Academic Topics (See Appendix A):

C1, C3, C4

Workplace Skills (See Appendix B):

WP1, WP4, WP6

Suggested Teaching Strategies:

1. *Apply basic electrical principles as they relate to vehicle circuits.*
 - a. *Have students read materials on the flow of electricity in a circuit. Define voltage, amperage, and resistance as related to the circuit. Discuss these principles with the students.*

- b. *Demonstrate the use of the multimeter (analog and digital) and continuity tester to the students. Have students practice the use of these instruments to measure voltage, amperage, and resistance in a circuit.*
 - c. *Provide students with examples of wiring diagrams from vehicles. Identify symbols used in these diagrams. Discuss the devices they represent. Have students draw a simple diagram representing a given circuit.*
 - d. *Have students create a simple circuit and test it for power and continuity.*
 - e. *Demonstrate procedures for testing an electrical circuit. Have students practice testing simple circuits which have been disabled.*
2. *Perform basic charging and starting system service.*
- a. *Demonstrate the procedure for starting a vehicle using jumper cables or auxiliary power source. Have students practice this procedure.*
 - b. *Demonstrate the proper procedure for performing a battery capacity test. Determine battery state and performing a slow/fast battery charge. Have students practice this procedure.*
 - c. *Demonstrate the procedure for removing and reinstalling a battery. Have students practice this procedure.*
 - d. *Demonstrate the procedure for performing a starter draw test and a starter voltage drop test. Determine needed repairs. Have students practice needed repairs.*
 - e. *Demonstrate the procedure for diagnosing charging system problems that cause undercharge, overcharge, or no charge condition.*
 - f. *Demonstrate the procedure for removing and replacing an alternator. Have students practice this procedure.*
 - g. *Demonstrate the procedure for removing and replacing a starter. Have students practice this procedure.*

Suggested Assessment Strategies:

- 1. *Apply basic electrical principles as they relate to vehicle circuits.*
 - a. *Test on basic principles of electricity.*
 - b. *Student exercise - Interpret wiring diagrams.*
 - c. *Student exercise - Build a simple circuit.*
 - d. *Student exercise - Diagnose a simple circuit.*
- 2. *Perform basic charging and starting system service.*
 - a. *Test on basic charging and starting system service.*
 - b. *Student exercise - Jump start a car.*
 - c. *Student exercise - Perform battery capacity test and slow/fast charge.*
 - d. *Student exercise - Remove and replace a battery.*
 - e. *Student exercise - Starter draw test and voltage drop test.*
 - f. *Student exercise - Diagnose charging system problems.*
 - g. *Student exercise - Remove and replace an alternator.*
 - h. *Student exercise - Remove and replace a starter.*

August 1, 1995

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1988.

**DIESEL ENGINE MECHANICS I
UNIT 5: BASIC VEHICLE SERVICE**

(20 days)

Competencies and Suggested Objectives:

1. Identify and describe the major systems and components of a vehicle.
 - a. Identify the major components. Describe their purpose/function of the following systems:
 - 1) Power trains
 - 2) Chassis, steering, and suspension
 - 3) Fuel
 - 4) Electrical
 - 5) Cooling
 - 6) Exhaust

Related Academic Topics (See Appendix A):

C1, C5, C6

Workplace Skills (See Appendix B):

WP2, WP4, WP5

2. Perform lubrication maintenance and general inspection service.
 - a. Compare a work order and maintenance record for a given vehicle.
 - b. Visually inspect the engine lubrication system for leaks and determine needed repairs.
 - c. Select proper lubricants and filters for lubrication service.
 - d. Change engine oil and filter according to manufacturer's specifications and in accordance with disposal procedures.
 - e. Perform a chassis and body lubrication.
 - f. Inspect and service as needed other filters on a diesel engine including air, fuel, crankcase vent filters, etc.
 - g. Conduct a general preventive maintenance inspection of hoses and belts, fluid levels, wiper blades, headlights and accessory lights, tires, exhaust, shocks, etc.; repair/replace/adjust as needed.
 - h. Clean and service battery including case, cables, and connections; and check electrolyte level (if applicable). (Maintain electronic memory functions while cleaning.)
 - i. Discuss differences in servicing a diesel engine as compared to a gasoline engine, including replacing fuel filters and bleeding the diesel fuel system.

Related Academic Topics (See Appendix A):

C2, C3, C5

Workplace Skills (See Appendix B):

WP2, WP4, WP6

3. Perform cooling system maintenance.
 - a. Service an air-cooled engines cooling system.
 - b. Drain and refill a cooling system.

- c. Inspect and pressure test a cooling system for proper operation; repair/replace thermostats, hoses, radiator caps, etc., as needed.

Related Academic Topics (See Appendix A):

C4, C5

Workplace Skills (See Appendix B):

WP1, WP5

4. Discuss the operation of brake systems used on heavy equipment and large trucks.
 - a. Discuss the operation of a mechanical brake system.
 - b. Discuss the operation of an air brake system.
 - c. Discuss the operation of a wet brake system.

Related Academic Topics (See Appendix A):

C5, C6

Workplace Skills (See Appendix B):

WP4, WP6

Suggested Teaching Strategies:

1. *Identify and describe the major systems and components of a vehicle.*
 - a. *Using a vehicle, visually identify the major systems and components to the students. Discuss their purpose/function.*
 - b. *Have students view a videotape on the operation of a four-stroke cycle engine. Discuss the information and processes shown on this videotape.*
 - c. *Have students view a videotape on the operation of a two-stroke cycle engine. Discuss the information and processes shown on the videotape.*
 - d. *Discuss the operation of a gasoline and a diesel engine, including its major parts and components. Develop a list of differences in the operation of the two engines.*
 - e. *Have students read background information on electronic and computer control. Discuss the use of electronic devices and computers in modern vehicle systems (electrical, fuel, emissions, brake, and climate control.)*
2. *Perform lubrication maintenance and general inspection service.*
 - a. *Have students read material on lubrication maintenance and general inspections. Discuss the material with students in class and demonstrate procedures to the class. Divide students into teams and have them practice a general lubrication maintenance and inspection job using a checklist.*
3. *Perform cooling system maintenance.*
 - a. *Discuss procedures for cooling system maintenance and demonstrate them to the class. Have students practice these procedures in the laboratory.*
4. *Discuss the operation of brake systems used on heavy equipment and large trucks.*
 - a. *Discuss the operation of a mechanical brake system with students. Use diagrams and examples if possible. Identify applications.*

- b. Discuss the operation of an air brake system with students. Use diagrams and examples if possible. Identify applications.*
- c. Discuss the operation of a wet brake system with students. Use diagrams and examples if possible. Identify applications.*
- d. Discuss the operation of a hydraulic brake system with students. Use diagrams and examples if possible. Identify applications.*

Suggested Assessment Strategies:

- 1. Identify and describe the major systems and components of a vehicle.*
 - a. Test - Purpose and functions of each system and four-stroke cycle engine.*
 - b. Student exercise - Identify specified systems on a vehicle in the shop.*
 - c. Test - Use of computer controls in modern vehicles.*
- 2. Perform lubrication maintenance and general inspection service.*
 - a. Student exercise - Lubrication and general inspection.*
- 3. Perform cooling system maintenance.*
 - a. Student exercise - Cooling system maintenance.*
- 4. Discuss the operation of brake systems used on heavy equipment and large trucks.*
 - a. Test on mechanical, air, wet and hydraulic brake systems.*

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1988.

August 1, 1995

DIESEL ENGINE MECHANICS II

DIESEL ENGINE MECHANICS II
UNIT 1: ORIENTATION & SAFETY

(5 days)

Competencies and Suggested Objectives:

1. Review occupational and leadership opportunities in Diesel Equipment Repair and Service.
 - a. Investigate occupational opportunities in the local area.
 - b. Update the student's Career/Educational Plan.
 - c. Describe leadership opportunities available from student youth organizations in the school and community, including VICA.

Related Academic Topics (See Appendix A):

C1, C4, C6

Workplace Skills (See Appendix B):

WP2, WP3, WP6

2. Demonstrate safety procedures used in vehicle service.
 - a. Apply safety rules for personal and general shop safety including eye (State Eye Safety Law provisions), ear, and body protection, general rules of shop conduct, and the use of safety color coding in vehicle shops.
 - b. Apply general safety rules for tool and shop equipment use including use of hand tools, air and electrical power tools, and other shop equipment.
 - c. Apply general safety rules associated with working on various vehicle systems.
 - d. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of fire fighting devices.

Related Academic Topics (See Appendix A):

C2, C4

Workplace Skills (See Appendix B):

WP5

3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.
 - a. Recognize signal words and symbols that indicate severity of a hazard.
 - b. Describe methods for reducing hazardous waste.
 - c. Describe procedures for storing hazardous waste.
 - d. Interpret data found on a hazardous material safety data sheet.
 - e. Describe general safety procedures to follow for first aid and cleanup, in case of an accident involving hazardous materials.
 - f. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Related Academic Topics (See Appendix A):

**C1, C2, C4
S5, S8**

Workplace Skills (See Appendix B):

WP2, WP3, WP4, WP5, WP6

Suggested Teaching Strategies:

1. **Review occupational and leadership opportunities in Diesel Equipment Repair and Service.**
 - a. **Have students survey job opportunities through employer visits, resource person(s), telephone calls, help-wanted ads, or a field trip. Report their findings to the class.**
 - b. **Have students update his/her Career/Educational Plan to reflect accomplishments and plans for future educational and occupational activities.**
 - c. **Discuss leadership opportunities with the students; such as competitive events (VICA and Ford/AAA), award and degree programs, and committee work; that are provided through student youth organizations. Allow students to practice leadership in class and laboratory activities.**
2. **Demonstrate safety procedures used in vehicle service.**
 - a. **Provide students with reading material on safety rules related to personal safety and general shop safety.**
 - b. **Demonstrate the safety rules and procedures for using tools and shop equipment. Provide simulations to allow students to practice these rules. Monitor students throughout the year on using these rules.**
 - c. **Provide instruction to students on safety rules related to vehicle engines. Demonstrate the applications of these rules and provide simulations to allow students to practice these rules. Monitor students throughout the year on using these rules.**
 - d. **Invite the local fire department to give a demonstration of fire safety and the use of fire detection and fighting equipment. Identify fire safety equipment, its location, and application(s) in the Diesel Equipment Repair & Service laboratory. Instruct students on its use.**
3. **Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.**
 - a. **Provide students with handouts or reading materials on the handling, storing, and disposing of hazardous materials. Discuss the use of signal words, and methods for reducing and storing hazardous waste.**
 - b. **Provide students with a copy of hazardous materials safety data sheet. Review and interpret the data found on the sheet with the class. Provide students with a second MSD for their interpretation.**

- c. *Provide students with information (text or videotape) on first aid and clean-up procedures in case of a hazardous material accident. Discuss these procedures with the class. Allow students to practice these procedures through a simulation.*
- d. *Discuss and demonstrate the procedures for handling, storing, and disposing of hazardous waste with the students. Have students practice these procedures through a simulation. Monitor students for compliance with these procedures throughout the year.*

Suggested Assessment Strategies:

- 1. *Review occupational and leadership opportunities in Diesel Equipment Repair and Service.*
 - a. *Oral and/or written report on job opportunities.*
 - b. *Review of Career/Educational Plan update.*
 - c. *Participation in leadership activities in class or laboratory.*
- 2. *Demonstrate safety procedures used in vehicle service.*
 - a. *Test on safety procedures, equipment, and rules.*
 - b. *Monitor students to assure that compliance with safety procedures becomes an integral part of their work habits.*
- 3. *Describe procedures for handling, storing, and disposing of hazardous materials.*
 - a. *Test on hazardous materials, signal words, reducing and storing, MSD's, and safety/first aid procedures.*
 - b. *Student exercise - Hazardous material accident simulation.*
 - c. *Student exercise - Handling, storing, and disposing of hazardous materials.*
 - d. *Monitor students to assure that compliance with hazardous materials procedures becomes an integral part of their work habits.*

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-American Vocational Curriculum Consortium, Inc., 1988.

DIESEL ENGINE MECHANICS II
UNIT 2: DIESEL ENGINE REBUILDING

(40 days)

Competencies and Suggested Objectives:

1. Disassemble diesel engine and evaluate its components.
 - a. Perform diesel engine disassembly process by utilizing service manual instructions for disassembly.
 - b. Clean diesel engine parts and compile a list of the parts utilizing parts manual listing.
 - c. Evaluate diesel engine components utilizing service manual specifications.

Related Academic Topics (See Appendix A):

C1, C2, C4, C6

Workplace Skills (See Appendix B):

WP1, WP4, WP5

2. Reassemble diesel engine.
 - a. Perform diesel engine assembly process by utilizing service manual for assembly sequence.
 - b. Perform diesel engine tightening operations after locating diesel engine tightening specifications in service manual.
 - c. Perform proper diesel engine overhead adjustments according to service manual procedures.

Related Academic Topics (See Appendix A):

C3, C4, C5

Workplace Skills (See Appendix B):

WP1, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Disassemble diesel engine and evaluate its components.*
 - a. *Have students read service manual instruction and list disassembly steps from the service manual utilizing the proper tools to disassemble the engine.*
 - b. *Have students clean parts using a parts washer and steam cleaner.*
 - c. *Have students locate and read service manual specifications and use the guidelines to evaluate the components by visual inspection. The students will measure components as required by the service manual and compile a list of replacement parts required.*
2. *Reassemble diesel engine.*
 - a. *Have students read service manual and discuss reassembly sequence. Have students demonstrate engine reassembly according to the service manual guidelines.*

- b. Have students read service manual for engine tightening operations. Demonstrate tightening procedures. Have students practice these procedures.*
- c. Have students read service manual for adjusting procedures. Demonstrate adjusting valves and injectors according to manufacturer specification. Have students practice these procedures.*

Suggested Assessment Strategies:

- 1. Disassemble diesel engine and evaluate its components.*
 - a. Test - Disassemble diesel engine.*
 - b. Student exercise - Clean disassemble parts.*
 - c. Student exercise - Evaluate components.*
- 2. Reassemble diesel engine.*
 - a. Test - Reassemble diesel engine.*
 - b. Student exercise - Tightening procedures.*
 - c. Student exercise - Diesel engine overhead adjustments.*

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum consortium, Inc., 1988.

DIESEL ENGINE MECHANICS II
UNIT 3: ENGINE PERFORMANCE

(35 days)

Competencies and Suggested Objectives:

1. Identify and relate auxiliary systems to engine performance including the following systems: lubrication, cooling, air induction, and exhaust.
 - a. Describe lubrication systems including flow, pressure regulation and bypass, oil properties, oil coolers, and filters; and list their effects on engine performance.
 - b. Describe liquid cooling system components including flow path, pump, radiator, hoses and belts, thermostats, and pressure caps. List their effects on engine performance.
 - c. Describe air induction including filter, turbo-chargers, blowers, and passages; and list their effects on engine performance.
 - d. Describe exhaust systems including manifold, mufflers, and exhaust outlets; and list their effects on engine performance.

Related Academic Topics (See Appendix A):

C4, C6

Workplace Skills (See Appendix B):

WP4, WP5, WP6

2. Identify and relate mechanical fuel systems to engine performance.
 - a. Discuss and locate components of diesel fuel systems.
 - b. Discuss distributor, scroll, and sleeve metering pumps.
 - c. Classify different fuel injection nozzles and calibrate nozzles according to manufacturer's specifications.
 - d. Classify different fuel unit injectors.
 - e. Classify different governors including mechanical, pneumatic, and hydraulic.

Related Academic Topics (See Appendix A):

C3, C5, C6

Workplace Skills (See Appendix B):

WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Identify and relate auxiliary systems to engine performance including the following systems: lubrication, cooling, air induction, and exhaust.*
 - a. *Have students read material on diesel engine lubrication system. Discuss different diesel engine lubrication components.*
 - b. *Provide information about liquid cooling systems. Discuss the different components of liquid cooling systems. Demonstrate cooling system tests. Have students practice these procedures.*

- c. *Have students read material on air induction. Discuss the effects of air induction to engine performance. Have the students compare and contrast turbo charged engines to blower charged engines.*
 - d. *Provide students with exhaust system information. Discuss the effects of restrictions in exhaust systems, hazards of leaks, and effects of exhaust temperature on engine performance.*
2. *Identify and relate mechanical fuel systems to engine performance.*
 - a. *Discuss the components of diesel engine fuel systems. Using a vehicle in the shop, show the student the location of the components of the diesel engine fuel system.*
 - b. *Provide students with information on the different types of pumps, distributors, scrolls, and sleeve metering. Discuss the difference of each type of pump.*
 - c. *Provide examples of different types of nozzles. Demonstrate how to change the opening pressure with use of the pop tester. Have student practice the procedure.*
 - d. *Provide examples of fuel unit injectors. Discuss how timing and metering of fuel is accomplished in unit injectors.*
 - e. *Provide examples of different types of governors. Discuss the application of different types of governors.*

Suggested Assessment Strategies:

1. *Identify and relate auxiliary systems to engine performance including the following systems: lubrication, cooling, air induction, and exhaust.*
 - a. *Test - Auxiliary systems effects on engine performance.*
 - b. *Student exercise - Lubrication components.*
 - c. *Student exercise - Cooling components.*
 - d. *Student exercise - Air induction.*
 - e. *Student exercise - Exhaust systems.*
2. *Identify and relate mechanical fuel systems to engine performance.*
 - a. *Test - Components of diesel fuel systems.*
 - b. *Test - Distributor, scroll, and metering pumps.*
 - c. *Student exercise - Classify fuel injection nozzles.*
 - d. *Student exercise - Classify fuel injector units.*
 - e. *Student exercise - Classify governors.*

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-American Vocational Curriculum Consortium, Inc., 1988.

**DIESEL ENGINE MECHANICS II
UNIT 4: ELECTRICAL SYSTEMS**

(35 days)

Competencies and Suggested Objectives:

1. Apply basic electrical principles as they relate to vehicle circuits.
 - a. Identify safety practices for electrical systems.
 - b. Identify electronic systems components and state their function in a circuit including fixed and variable resistors, diodes, thermistors, and transducers.
 - c. Measure voltage, amperage, and resistance in electronic circuits utilizing a digital volt ohm meter and compare measurements to manufacturer's service specifications.
 - d. Differentiate among open, grounded, and short circuits.
 - e. Service and test the starting and charging systems components.

Related Academic Topics (See Appendix A):

C3, C4, C5

Workplace Skills (See Appendix B):

WP1, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Apply basic electrical principles as they relate to vehicle circuits.*
 - a. *Provide instruction to students on safety practices for electrical systems. Demonstrate the application of these practices and provide simulations to allow students to practice these rules.*
 - b. *Provide student with electronic system components information. Discuss the function of electronic system components in a circuit.*
 - c. *Demonstrate electronic circuit measurement. Have students practice these procedures.*
 - d. *Provide students with information about different types of circuits. Discuss the difference between an open circuit, a grounded circuit, and a short circuit.*
 - e. *Demonstrate service and testing procedures for starting and charging systems components. Have students practice these procedures.*

Suggested Assessment Strategies:

1. *Apply basic electrical principles as they relate to vehicle circuits.*
 - a. *Test - Safety practices.*
 - b. *Student exercise - Electronic components*
 - c. *Student exercise - Electronic Circuit Measurements*
 - d. *Student exercise - Circuit types.*
 - e. *Student exercise - Testing procedures.*

August 1, 1995

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1988.

**DIESEL ENGINE MECHANICS II
UNIT 5: HYDRAULICS**

(10 days)

Competencies and Suggested Objectives:

1. Perform basic service on a hydraulic system.
 - a. Discuss hazards and safety procedures for working with hydraulic systems.
 - b. Discuss the operation of a hydraulic system including components and their functions, and operating principles.
 - c. Compare the operation of a closed-center and open-centered hydraulic system.
 - d. Inspect a hydraulic system for leaks, and determine needed repairs.
 - e. Calculate force using pressure and area of various size cylinders.

Related Academic Topics (See Appendix A):

C3, C6

Workplace Skills (See Appendix B):

WP1, WP4, WP6

Suggested Teaching Strategies:

1. *Perform basic service on a hydraulic system.*
 - a. *Discuss hazards and safety procedures for working with hydraulic systems, including risk of hydraulic fluid poison and precautions to follow in servicing hydraulic systems.*
 - b. *Discuss the operation of a hydraulic system including components and their functions, and operating principles. Be sure to discuss and illustrate the different types of pumps, valves, cylinders, and other devices associated with hydraulic systems.*
 - c. *Compare the operation of a closed-center and open-centered hydraulic system. Use diagrams or videotape if possible to illustrate the concept.*
 - d. *Demonstrate the procedures for inspection of a hydraulic system for leaks and determining needed repairs. Provide students with a problem in which they have to determine needed repairs on a system.*
 - e. *Provide students with formula to calculate forces. Demonstrate the application of the formula using available cylinders. Have students practice calculations and procedures.*

Suggested Assessment Strategies:

1. *Perform basic service on a hydraulic system.*
 - a. *Test on hydraulic system safety, operation, and components.*
 - b. *Student exercise - Diagnose repairs to a leaking hydraulic system.*
 - c. *Student exercise - Calculate forces.*

August 1, 1995

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1988.

**DIESEL ENGINE MECHANICS II
UNIT 6: POWER TRAINS**

(10 days)

Competencies and Suggested Objectives:

1. Perform basic driveline service/repair.
 - a. Inspect, diagnose and replace universal joints.
 - b. Remove and replace axle bearings and seals as needed.
 - c. Measure differential backlash using a dial indicator.

Related Academic Topics (See Appendix A):
C1, C3, C6

Workplace Skills (See Appendix B):
WP1, WP5, WP6
2. Perform clutch service.
 - a. Remove, inspect, make needed repairs, and reassemble a clutch assembly including flywheel, pressure plate, disc, and release assembly.
 - b. Adjust clutch linkage for free travel.

Related Academic Topics (See Appendix A):
C3, C6

Workplace Skills (See Appendix B):
WP1, WP4, WP6
3. Perform basic transmission service.
 - a. Service a transmission including changing fluid and checking fluid levels.
 - b. Visually inspect transmission including checking for leaks, and examining condition of fluid.

Related Academic Topics (See Appendix A):
C4, C6

Workplace Skills (See Appendix B):
WP5, WP6

Suggested Teaching Strategies:

1. Perform basic driveline service and repair.
 - a. Discuss and demonstrate procedures for inspecting, diagnosing, and replacing universal joints. Have students practice these procedures.
 - b. Discuss and demonstrate procedures for removing axle bearings and seals. Have students practice these procedures.
 - c. Discuss and demonstrate procedures for measuring differential backlash using a dial indicator. Have students practice these procedures.
2. Perform clutch service.
 - a. Discuss and demonstrate procedures for removing, inspecting, repairing and reassembling a clutch. Have students practice these procedures in class.

- b. Discuss and demonstrate procedures for adjusting clutch free travel. Have students practice these procedures.*
- 3. Perform basic transmission service.**
 - a. Discuss and demonstrate procedures for changing fluid and checking fluid levels. Have students practice these procedures.*
 - b. Describe and demonstrate procedures for visually inspecting a transmission and the condition of its fluid. Have students practice these procedures in class.*

Suggested Assessment Strategies:

- 1. Perform basic driveline service.**
 - a. Test on material discussed in class.*
 - b. Student exercise - Remove and replace axle bearings and seals.*
 - c. Student exercise - Measure differential backlash.*
- 2. Perform clutch service.**
 - a. Test on material discussed in class.*
 - b. Student exercise - Remove, inspect, repair, and reassemble a clutch assembly.*
 - c. Student exercise - Adjust clutch linkage free travel.*
- 3. Perform basic transmission service.**
 - a. Student exercise - Service a transmission.*
 - b. Student exercise - Visual inspection of a transmission.*

Suggested References:

Textbook (to be adopted)

Diesel Fundamentals. Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1988.

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SECTION III:
RECOMMENDED TOOLS AND EQUIPMENT

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**RECOMMENDED TOOLS AND EQUIPMENT
FOR SECONDARY DIESEL EQUIPMENT REPAIR & SERVICE**

1. Student Tool Kit (1 kit per 3 students)
 - a. Adjustable wrenches (2) 6" and 12"
 - b. Allen wrench sets - standard (.050" - 3/8") and Metric (2mm - 7mm)
 - c. Brake spoon
 - d. Chisels - cape (5/16") and cold (3/8" & 3/4")
 - e. Claw type pickup tool
 - f. Combination wrench sets - standard (1/4" - 1") and Metric (7mm - 19 mm)
 - g. Continuity test light (12v)
 - h. Feeler gauge (blade type) .002" - .040 " and .006 mm - .070 mm
 - i. Hack saw
 - j. Hammer - 16 oz. ball peen
 - k. Hammer - plastic tip
 - l. Ignition wrench set - US and Metric
 - m. Magnetic pickup tool
 - n. Pliers - combination 6", locking jaw, needle nose, side cutting, and slip joint (water pump)
 - o. Punches - center, brass drift, pin (1/8", 3/16", 1/4", 5/16") , and taper (3/8", 1/2", 5/8")
 - p. Scrapers - carbon 1" and gasket 1"
 - q. Screwdrivers - standard (stubby, 6", 9", 12", and offset) and Phillips (stubby #1, #2; 6" #1, #2; 12" #3)
 - r. Screw starters - standard and Phillips
 - s. Socket set - 1/4" drive - 1/4"-1/2" standard sockets, 1/4"-1/2" deep sockets, 6mm-12mm standard sockets, 6mm-12mm deep sockets, flex/universal type handle, 3" and 6" extensions, ratchet
 - t. Socket set - 3/8" drive - 5/16"-3/4" standard sockets; 3/8"-3/4" deep sockets; 9mm-19mm standard sockets; 9mm-19mm deep sockets; 3", 6", 12", and 18" extensions; flexhead ratchet; ratchet; speed handle; universal joint; spark plug sockets (5/8" & 13/16")
 - u. Socket set - 1/2" drive - 7/16" - 1 1/8" standard sockets; 7/16" - 1 1/8" deep sockets; 10mm - 25mm standard sockets; 10mm - 25mm deep sockets; 3", 6", and 12" extensions; flex/universal type handle, ratchet
 - v. Spark plug feeler gauge (gap tool)
2. Air blow gun (OSHA approved) (2)
3. Hydraulic floor jack (minimum capacity - 1-10 tons)
4. Battery post cleaner (2/yr.)
5. Battery terminal pliers (2)
6. Battery terminal puller (2)
7. Files - coarse 6" & 12", fine 6" & 12", half-round 12", and round 6" & 12" (2 sets)

8. Flare nut (tubing wrenches) 3/8" - 3/4" and 10mm - 17mm (2)
9. Flashlight (3)
10. Hammer - dead blow plastic mallet (4)
11. Jumper wire set (2)
12. Pliers - hose clamp (2)
13. Pry bars - rolling head and straight (2 sets)
14. Screwdriver set - Torx® T-8 - T-55 (1 set)
15. 3/8" drive air ratchet (1)
16. 3/8" drive impact sockets (US and Metric) (2 sets)
17. 3/8" drive impact wrench (2)
18. 3/8" drive flexible socket set (US and Metric) (2 sets)
19. 1/2" drive air impact wrench (1)
20. 1/2" drive impact sockets (US and Metric) (2 sets)
21. 3/4" drive air impact wrench (1)
22. 3/4" drive impact sockets (US and Metric) (2 sets)
23. Air chisel with various bits (1 set)
24. Air compressor and hoses (4 @ 50')
25. Torque wrenches (2-1/4", 2-3/8", 2-1/2", 1-3/4")
26. Axle stands (heavy duty - minimum 1 ton capacity) (1 set)
27. 2 or 4 post above ground lift (1 per program)
28. Hydraulic power puller set (minimum capacity 10 tons) (1)
29. Battery charger/booster starter (1)
30. Belt tensioner gauge (1)
31. Bench or pedestal grinder (2)
32. Compression tester (universal-type for use with both diesel and gasoline engines.) (1)
33. Cooling system pressure tester (1)
34. Floor creeper (4)
35. Cylinder leakage tester (1)
36. Dial indicator with flex arm and clamp base (4 sets)
37. Digital multimeter with various leadsets (6)
38. Drain pans (4)
39. Drill - 3/8" variable speed (2)
40. Drill - 1/2" variable speed (1)
41. Engine hoist (heavy duty) (1)
42. Extension cords (6 @ 50')
43. Fender covers (2)
44. Gear lube dispenser (1)
45. High pressure washer (1)
46. Hot plate (or equivalent) (1)
47. Hydraulic bottle jacks (minimum capacity - 10 tons) (2)
48. Hydraulic press with adapters (25 ton) (1)
49. Jumper cables (commercial/industrial duty) (1)
50. Master puller set (1 complete set)

51. Microcomputer with monitor, printer, CD-ROM drive and cables (1)
52. Microcomputer service information software (CD-ROM)
53. Outside micrometers (0-1", 1-2", 2-3", 3-4", 4-5", 5-6", 6-7") (6)
54. Oil can - pump type (2)
55. Oil filter wrench(es) (1 set)
56. Parts cleaning tank (1)
57. Parts cleaning tank (hot-type, EPA approved) (1)
58. Remote starter switch (2)
59. Screw extractor set (1)
60. Sledges - 8lb. and 16 lb. (1 ea.)
61. Snap ring pliers set - external and internal (2 sets)
62. Soldering gun (4)
63. Soldering iron (25 watt pencil type) (4)
64. Steel top workbenches with 6" and 8" vises (6)
65. Tach/dwell meter (1)
66. Tap and Die set (US and Metric - heavy duty, industrial grade) (2 sets)
67. Thread repair insert kit (1)
68. Tire inflator chuck (1)
69. Trouble/work lights (4)
70. Tubing cutter and flaring set (1)
71. Twist steel drill bit set (1/64" - 1") (2)
72. Valve core removal tool (1)
73. Vernier calipers (0-6" and 0-125mm) (6)
74. Waste oil receptacle (1)
75. Ball joint press (1)
76. Bearing packer (2)
77. Drag link tool (1)
78. Inner tie rod end tool (1)
79. Pitman arm puller (1)
80. Shock absorber tools (1)
81. Tie rod puller (1)
82. Brake bleeder, pressure (1)
83. Brake cylinder clamps (1)
84. Brake disc micrometer
85. Brake lathe with disc service attachments (1)
86. Brake shoe adjusting gauge (1 set)
87. Brake spring installers (1 set)
88. Brake spring pliers (1 set)
89. Asbestos containment/removal device (1)
90. Antifreeze tester (1)
91. Battery/starter/charging system tester (heavy duty) (1)
92. Cylinder leakage tester (1)
93. Sending unit socket (1 set)
94. Timing advance light (1)

95. Vacuum/pressure gauge set (1)
96. Transmission jack (1 heavy duty)
97. Alternator service tools (2 sets)
98. Wire and terminal repair kit (4)
99. Clutch alignment set (1)
100. Clutch pilot puller set (1)
101. Universal joint tools (1 set)
102. Valve and valve seat resurfacing equipment (1)
103. Valve guide repair unit (1)
104. Valve spring compressor (4)
105. Valve spring tester (1)
106. Dial bore gauges (8" capacity) (2)
107. Cylinder hones (7" capacity) (2)
108. Cam bearing installation tool (1)
109. Crankshaft v-blocks (6 sets)
110. Engine pre-oiler (1)
111. Cylinder liner pullers (1 set)
112. Protusion gauge (1)
113. Precision straight edge 4' (2)
114. Piston ring compressor tools (6)
115. Magnetic crack detector (1)
116. Axle bearing nut set (1)
117. U-joint puller (1)
118. Hydraulic pressure testing equipment (1)
119. Diesel fuel injector nozzle pop tester (1)
120. Tune-up tool sets for diesel (1)
121. U2 manometer (1)
122. Digital pyrometer (1)
123. Heavy duty drill press (1)
124. Oxy/acetylene welding and cutting set (1)
125. Shielded metal arc welder (1)
126. Metal inert gas (MIG) welder (1)

August 1, 1995

APPENDIX A:
RELATED ACADEMIC TOPICS

APPENDIX A

RELATED ACADEMIC TOPICS FOR COMMUNICATIONS

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C3 Listen, comprehend, and take appropriate actions.
- C4 Access, organize, and evaluate information.
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.

EXPANDED TOPICS FOR COMMUNICATIONS

TOPIC C1: Interpret written material.

- C1.01 Read and follow complex written directions.
- C1.02 Recognize common words and meanings associated with a variety of occupations.
- C1.03 Adjust reading strategy to purpose and type of reading.
- C1.04 Use sections of books and reference sources to obtain information.
- C1.05 Compare information from multiple sources and check validity.
- C1.06 Interpret items and abbreviations used in multiple forms.
- C1.07 Interpret short notes, memos, and letters.
- C1.08 Comprehend technical words and concepts.
- C1.09 Use various reading techniques depending on purpose for reading.
- C1.10 Find, read, understand, and use information from printed matter or electronic sources.

TOPIC C2: Interpret visual materials (maps, charts, graphs, tables, etc.).

- C2.01 Use visuals in written and in oral presentations.
- C2.02 Recognize visual cues to meaning (layout, typography, etc.).
- C2.03 Interpret and apply information using visual materials.

TOPIC C3: Listen, comprehend, and take appropriate action.

- C3.01 Identify and evaluate orally-presented messages according to purpose.
- C3.02 Recognize barriers to effective listening.
- C3.03 Recognize how voice inflection changes meaning.
- C3.04 Identify speaker signals requiring a response and respond accordingly.
- C3.05 Listen attentively and take accurate notes.
- C3.06 Use telephone to receive information.

C3.07 Analyze and distinguish information from formal and informal oral presentations.

TOPIC C4: Access, organize, and evaluate information.

C4.01 Distinguish fact from opinion.

C4.02 Use various print and non-print sources for specialized information.

C4.03 Interpret and distinguish between literal and figurative meaning.

C4.04 Interpret written or oral communication in relation to context and writer's point of view.

C4.05 Use relevant sources to gather information for written or oral communication.

TOPIC C5: Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.

C5.01 Select appropriate words for communication needs.

C5.02 Use reading, writing, listening, and speaking skills to solve problems.

C5.03 Compose inquiries and requests.

C5.04 Write persuasive letters and memos.

C5.05 Edit written reports, letters, memos, and short notes for clarity, correct grammar, and effective sentences.

C5.06 Write logical and understandable statements, phrases, or sentences for filling out forms, for correspondence or reports.

C5.07 Write directions or summaries of processes, mechanisms, events, or concepts.

C5.08 Select and use appropriate formats for presenting reports.

C5.09 Convey information to audiences in writing.

C5.10 Compose technical reports and correspondence that meet accepted standards for written communications.

TOPIC C6: Communicate ideas and information using oral and written forms for a variety of audiences and purposes.

C6.01 Give complex oral instructions.

C6.02 Describe a business or industrial process/mechanism.

C6.03 Participate effectively in group discussions and decision making.

C6.04 Produce effective oral messages utilizing different media.

C6.05 Explore ideas orally with partners.

C6.06 Participate in conversations by volunteering information when appropriate and asking relevant questions when appropriate.

C6.07 Restate or paraphrase a conversation to confirm one's own understanding.

C6.08 Gather and provide information utilizing different media.

- C6.09** Prepare and deliver persuasive, descriptive, and demonstrative oral presentations.

RELATED ACADEMIC TOPICS FOR MATHEMATICS

- M1** Relate number relationships, number systems, and number theory.
- M2** Explore patterns and functions.
- M3** Explore algebraic concepts and processes.
- M4** Explore the concepts of measurement.
- M5** Explore the geometry of one-, two-, and three-dimensions.
- M6** Explore concepts of statistics and probability in real world situations.
- M7** Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

EXPANDED TOPICS FOR MATHEMATICS

TOPIC M1: Relate number relationships, number systems, and number theory.

- M1.01** Understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, and scientific notation) in real world and mathematical problem situations.
- M1.02** Develop number sense for whole numbers, fractions, decimals, integers, and rational numbers.
- M1.03** Understand and apply ratios, proportions, and percents in a wide variety of situations.
- M1.04** Investigate relationships among fractions, decimals, and percents.
- M1.05** Compute with whole numbers, fractions, decimals, integers, and rational numbers.
- M1.06** Develop, analyze, and explain procedures for computation and techniques for estimations.
- M1.07** Select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods.
- M1.08** Use computation, estimation, and proportions to solve problems.
- M1.09** Use estimation to check the reasonableness of results.

TOPIC M2: Explore patterns and functions.

- M2.01** Describe, extend, analyze, and create a wide variety of patterns.
- M2.02** Describe and represent relationships with tables, graphs, and rules.
- M2.03** Analyze functional relationships to explain how a change in one quantity results in a change in another.
- M2.04** Use patterns and functions to represent and solve problems.
- M2.05** Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations.

- M2.06** Use a mathematical idea to further their understanding of other mathematical ideas.
- M2.07** Apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, and business.

TOPIC M3: Explore algebraic concepts and processes.

- M3.01** Represent situations and explore the interrelationships of number patterns with tables, graphs, verbal rules, and equations.
- M3.02** Analyze tables and graphs to identify properties and relationships and to interpret expressions and equations.
- M3.03** Apply algebraic methods to solve a variety of real world and mathematical problems.

TOPIC M4: Explore the concepts of measurement.

- M4.01** Estimate, make, and use measurements to describe and compare phenomena.
- M4.02** Select appropriate units and tools to measure to the degree of accuracy required in a particular situation.
- M4.03** Extend understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass.
- M4.04** Understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs.

TOPIC M5: Explore the geometry of one-, two-, and three-dimensions.

- M5.01** Identify, describe, compare, and classify geometric figures.
- M5.02** Visualize and represent geometric figures with special attention to developing spatial sense.
- M5.03** Explore transformations of geometric figures.
- M5.04** Understand and apply geometric properties and relationships.
- M5.05** Classify figures in terms of congruence and similarity and apply these relationships.

TOPIC M6: Explore the concepts of statistics and probability in real world situations.

- M6.01** Systematically collect, organize, and describe data.
- M6.02** Construct, read, and interpret tables, charts, and graphs.
- M6.03** Develop an appreciation for statistical methods as powerful means for decision making.
- M6.04** Make predictions that are based on exponential or theoretical probabilities.

M6.05 Develop an appreciation for the pervasive use of probability in the real world.

TOPIC M7: Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

M7.01 Use computers and/or calculators to process information for all mathematical situations.

M7.02 Use problem-solving approaches to investigate and understand mathematical content.

M7.03 Formulate problems from situations within and outside mathematics.

M7.04 Generalize solutions and strategies to new problem situations.

RELATED ACADEMIC TOPICS FOR SCIENCE

S1 Explain the Anatomy and Physiology of the human body.

S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.

S3 Relate the nine major phyla of the kingdom anomaly according to morphology, anatomy, and physiology.

S4 Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.

S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.

S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.

S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.

S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

EXPANDED TOPICS FOR SCIENCE

TOPIC S1: Explain the Anatomy and Physiology of the human body.

S1.01 Recognize common terminology and meanings.

S1.02 Explore the relationship of the cell to more complex systems within the body.

- S1.03 Summarize the functional anatomy of all the major body systems.
- S1.04 Relate the physiology of the major body systems to its corresponding anatomy.
- S1.05 Compare and contrast disease transmission and treatment within each organ system.
- S1.06 Explore the usage of medical technology as related to human organs and organ systems.
- S1.07 Explain the chemical composition of body tissue.

TOPIC S2: Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.

- S2.01 Identify the major types and structures of plants, viruses, monera, algae protista, and fungi.
- S2.02 Explain sexual and asexual reproduction.
- S2.03 Describe the ecological importance of plants as related to the environment.
- S2.04 Analyze the physical chemical and behavioral process of a plant.

TOPIC S3: Relate the nine major phyla of the kingdom anomaly according to morphology, anatomy, and physiology.

- S3.01 Explain the morphology, anatomy, and physiology of animals.
- S3.02 Describe the characteristics, behaviors, and habitats of selected animals.

TOPIC S4: Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.

- S4.01 Examine minerals and their identification, products of the rock cycle, byproducts of weathering, and the effects of erosion.
- S4.02 Relate the Hydrologic Cycle to include groundwater its zones, movement, and composition; surface water systems, deposits, and runoff.
- S4.03 Consider the effects of weather and climate on the environment.
- S4.04 Examine the composition of seawater; wave, tides, and currents; organisms, environment, and production of food; energy, food and mineral resources of the oceans.

TOPIC S5: Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.

- S5.01 Examine the science of chemistry to include the nature of matter, symbols, formulas and nomenclature, and chemical equations.

- S5.02 Identify chemical reactions including precipitation, acids-bases, and reduction-oxidation.
- S5.03 Explore the fundamentals of chemical bonding and principles of equilibrium.
- S5.04 Relate the behavior of gases.
- S5.05 Investigate the structure, reactions, and uses of organic compounds; and investigate nuclear chemistry and radiochemistry.

TOPIC S6: Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.

- S6.01 Examine fundamentals of motion of physical bodies and physical dynamics.
- S6.02 Explore the concepts and relationships among work, power, and energy.
- S6.03 Explore principles, characteristics, and properties of electricity, magnetism, light energy, thermal energy, and wave energy.
- S6.04 Identify principles of modern physics related to nuclear physics.

TOPIC S7: Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance; population genetics, the structure and function of DNA, and current applications of DNA technology.

- S7.01 Examine principles, techniques, and patterns of traits and inheritance in organisms.
- S7.02 Apply the concept of population genetics to both microbial and multicellular organism.
- S7.03 Identify the structure and function of DNA and the uses of DNA technology in science, industry, and society.

TOPIC S8: Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

- S8.01 Apply the components of scientific processes and methods in classroom and laboratory investigations.
- S8.02 Observe and practice safe procedures in the classroom and laboratory.
- S8.03 Demonstrate proper use and care for scientific equipment.
- S8.04 Investigate science careers, and advances in technology.
- S8.05 Communicate results of scientific investigations in oral, written, and graphic form.

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APPENDIX B:
WORKPLACE SKILLS

**APPENDIX B
WORKPLACE SKILLS FOR THE 21ST CENTURY**

- WP1 Allocates resources (time, money, materials and facilities, and human resources).**
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.**
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.**
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.**
- WP5 Selects, applies, and maintains/troubleshoots technology.**
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.**

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APPENDIX C:
STUDENT COMPETENCY PROFILE

**STUDENT COMPETENCY PROFILE
FOR DIESEL ENGINE MECHANICS I**

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation and Safety

- _____ 1. Review occupational and leadership opportunities in Diesel Equipment Repair and Service.
- _____ 2. Demonstrate safety procedures used in vehicle service.
- _____ 3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Unit 2: Tools, Technical References, Measurement, and Fasteners

- _____ 1. Demonstrate proper use and storage of tools and equipment in a vehicle shop.
- _____ 2. Locate and apply service specifications and information.
- _____ 3. Demonstrate measurement practices used in vehicle service.
- _____ 4. Identify common fasteners and describe their use.

Unit 3: Basic Engine Operation Principles

- _____ 1. Describe the basic operation principles of a diesel engine.

Unit 4: Basic Electrical Service

- _____ 1. Apply basic electrical principles as they relate to vehicle circuits.
- _____ 2. Perform basic charging and starting system service. overcharge, or no charge condition.

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Unit 5: Basic Vehicle Service

1. Identify and describe the major systems and components of a vehicle.
2. Perform lubrication maintenance and general inspection service.
3. Perform cooling system maintenance.
4. Discuss the operation of brake systems used on heavy equipment and large trucks.

STUDENT COMPETENCY PROFILE FOR DIESEL ENGINE MECHANICS II

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation & Safety

- _____ 1. Review occupational and leadership opportunities in Diesel Equipment Repair and Service.
- _____ 2. Demonstrate safety procedures used in vehicle service.
- _____ 3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Unit 2: Diesel Engine Rebuilding

- _____ 1. Disassemble diesel engine and evaluate its components.
- _____ 2. Reassemble diesel engine.

Unit 3: Engine Performance

- _____ 1. Identify and relate auxiliary systems to engine performance including the following systems: lubrication, cooling, air induction, and exhaust.
- _____ 2. Identify and relate mechanical fuel systems to engine performance.

Unit 4: Electrical Systems

- _____ 1. Apply basic electrical principles as they relate to vehicle circuits.

Unit 5: Hydraulics

- _____ 1. Perform basic service on a hydraulic system.

Unit 6: Power Trains

- _____ 1. Perform basic driveline service/repair.
- _____ 2. Perform clutch service.
- _____ 3. Perform basic transmission service.