



# Broward Community College

## Course Outline

STATUS:     A    

COMMON COURSE NUMBER:   DIM 1010  

COURSE TITLE:   Advanced Diesel Engine Theory and Repair  

CREDIT HOURS:           6          

**CONTACT HOURS BREAKDOWN:**

Lecture/Discussion           48          

Lab           96          

Other                           

Contact Hours/Week           9          

**CATALOG COURSE DESCRIPTION:**

Prerequisite: DIM 1001

Corequisite: None

A course designed to teach the principles, operations, maintenance diagnosis, and repair of medium and heavy vehicle diesel engines. Topics include diagnosis, and repair of cylinder head and valve train, engine block, lubrication, system, cooling system, air induction and exhaust systems, fuel system and engine brakes.

**UNIT TITLES (SEE NEXT PAGE)**

**UNIT TITLES:**

- 1. Diesel Engine Theory and Operation**
- 2. General Engine Diagnosis and Repair**
- 3. Cylinder Head and Valve Train Theory and Operation**
- 4. Cylinder head and Valve Train Diagnosis and Repair**
- 5. Engine Block Theory and Operation**
- 6. Engine Block Diagnosis and Repair**
- 7. Lubrication System Theory and Operation**
- 8. Lubrication System Diagnosis and Repair**
- 9. Cooling System Theory and Operation**
- 10. Cooling System Diagnosis and Repair**
- 11. Air Induction and Exhaust Systems Theory and Operation**
- 12. Air Induction and Exhaust Systems Diagnosis and Repair**
- 13. Fuel System Theory and Operation**
- 14. Fuel System Diagnosis and Repair**
- 15. Engine Brake Theory and Operation**
- 16. Engine Brake Diagnosis and Repair**

**I. Course Overview:**

Upon successful completion of this course, the students should be able to describe

**II. Units:**

**Unit 1. Diesel Engine Theory and Operation**

General Outcome:

- 1.0 The students should be able to describe the construction and operation of a typical medium or heavy-duty diesel engine and its major components.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 1.1 Identify diesel engine types and describe their characteristics.
- 1.2 Identify components of a diesel engine, including the material from which it was manufactured and its purpose.
- 1.3 Describe the fuels and lubricants used in diesel engines and identify their properties.
- 1.4 Identify special safety procedures that should be observed when working with heavy-duty diesel engines.

## Unit 2. General Engine Diagnosis and Repair

### General Outcome:

- 2.0 The students should be able to perform maintenance, diagnosis and repair procedures on medium and heavy-duty diesel engines.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 2.1 Describe the manufacturers recommended maintenance schedule for each major diesel engine type.
- 2.2 Perform scheduled maintenance in accordance with manufacturer's recommendations.
- 2.3 Determine and interpret operators' complaints; review vehicle history and determine appropriate inspections and tests.
- 2.4 Inspect fuel, oil and coolant levels and condition.
- 2.5 Evaluate engine exhaust color and quantity and determine needed repairs.
- 2.6 Perform engine tests including air intake system restriction, air box pressure, and crankcase pressure and exhaust back pressure.
- 2.7 Detect and evaluate engine performance problems including no cranking, no start, no run, surging, rough operation, misfiring, low power, slow acceleration or deceleration, and engine vibration.

### **Unit 3. Cylinder Head and Valve Train Theory and Operation**

#### General Outcome:

- 3.0 The students should be able to describe the construction and operation of medium and heavy-duty diesel engine head and valve train assemblies.

#### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 3.1 Describe the construction and operation of diesel engine valve trains and their component parts, and identify the materials from which they are manufactured.
- 3.2 Describe the construction and operation of diesel engine valve trains and their component parts, and identify the materials from which they are manufactured.

## Unit 4. Cylinder Head and Valve Train Diagnosis and Repair

### General Outcome:

- 4.0 The students should be able to perform maintenance, diagnosis and repair procedures on medium and heavy-duty diesel engine heads and valve trains.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 4.1 Remove, clean, inspect, and reinstall a cylinder head assembly.
- 4.2 Clean and inspect all valve train assembly components.
- 4.3 Perform cylinder head and valve train scheduled maintenance procedures in accordance with manufacturer's recommendation.
- 4.4 Diagnose cylinder head and valve train problems.
- 4.5 Perform cylinder head and valve train repairs.
- 4.6 Reassemble cylinder head and valve train assembly and adjust as required.

## **Unit 5. Engine Block Theory and Operation**

### General Outcome:

- 5.0 The students should be able to describe the construction and operation of medium and heavy-duty diesel engine blocks and related components.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 5.1 Describe the purpose, construction and operation of diesel engine blocks.
- 5.2 Describe the purpose, construction and operation of engine related components.

## Unit 6. Engine Block Diagnosis and Repair

### General Outcome:

- 6.0 The students should be able to perform maintenance diagnosis and repair procedures on medium and heavy-duty diesel engine blocks and related components.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 6.1 Inspect engine block and bores for cracks, warpage, wear and damage.
- 6.2 Inspect, measure and test as appropriate, all engine block related components, including cylinder sleeves or walls, pistons connecting rods, crankshafts, bearings, camshafts, timing gears, fly wheels, flexplates, pans, covers, vents, gaskets, seals, wear rings and piston rings.
- 6.3 Diagnose problems with engine blocks and related components.
- 6.4 Perform basic engine block repairs, including cylinder sleeve removal and replacement.
- 6.5 Diagnose problems with block-related components.
- 6.6 Perform repairs to engine block-related components.

## Unit 7. Lubrication System Theory and Operation

### General Outcome:

- 7.0 The students should be able to describe the construction and operation of medium and heavy-duty diesel engine lubrication systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 7.1 Describe the construction, including the materials used in the manufacture of diesel lubrication systems.
- 7.2 Describe the purpose and proper operation of diesel lubrication systems.

## **Unit 8. Lubrication System Diagnosis and Repair**

### General Outcome:

- 8.0 The students should be able to perform maintenance, diagnosis and repair procedures on medium and heavy-duty diesel engine lubrication systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 8.1 Perform routine maintenance procedures on diesel, lubrication systems, according to manufacturers' recommendations.
- 8.2 Inspect, clean, test and measure, as appropriate, engine oil pressure, oil level, condition and consumption, oil pump, drive inlet pipe and screen, pressure regulator valves, by-passes, pressure relief valves, filters, oil coolers, differential valve thermostat and turbocharger lubrication system.
- 8.3 Diagnose diesel engine lubrication system problems.
- 8.4 Repair, install, replace and adjust all lubrication system components.

## Unit 9. Cooling System Theory and Operation

### General Outcome:

- 9.0 The students should be able to describe the construction and operation of medium and heavy-duty diesel engine cooling systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 9.1 Describe the construction, including materials used in manufacture, of diesel engine cooling systems.
- 9.2 Describe the purpose and operation of diesel engine cooling systems.

## Unit 10. Cooling System Diagnosis and Repair

### General Outcome:

- 10.0 The students should be able to perform maintenance diagnosis and repair procedures on medium and heavy-duty diesel engine cooling systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 10.1 Perform routine maintenance procedures on diesel engine cooling systems, according to manufacturers' recommendations.
- 10.2 Inspect, clean, test and measure, as appropriate, each cooling system component, including radiators, thermostat, hoses, clamps, recovery systems water pump, thermistors, fan hub, clutch and shrouds, pressure cap, coolant conditioner/filters and air shutters.
- 10.3 Diagnose diesel engine cooling system problems including overheating and coolant leaks.
- 10.4 Perform diesel engine cooling system repairs, including removal, disassembly, replacement and adjustment procedures.

## Unit 11. Air Induction and Exhaust Systems Theory and Operation

### General Outcome:

- 11.0 The students should be able to describe the construction and operation of typical medium and heavy-duty diesel engine air induction and exhaust systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 11.1 Describe the purpose, construction and operation of a diesel engine air induction system and its components.
- 11.2 Describe the purpose, construction and operation of a diesel engine exhaust system and its components.

## Unit 12. Air Induction and Exhaust System Diagnosis and Repair

### General Outcome:

- 12.0 The students should be able to perform maintenance, diagnosis and repair procedures on medium and heavy-duty diesel engine air induction and exhaust systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 12.1 Perform routine maintenance procedures on diesel air induction and exhaust systems according to manufacturers' recommendations.
- 12.2 Inspect clean and test air induction system components including induction piping, air cleaners, manifolds and gaskets and turbochargers, intercoolers, and wastegates.
- 12.3 Inspect, clean and test exhaust system components, including exhaust manifolds and gaskets, piping mufflers and EGR valves.
- 12.4 Diagnose diesel engine air induction and exhaust system problems.
- 12.5 Perform diesel engine air induction and exhaust system repairs, including removal, disassembly, replacement and adjustment procedures.

## Unit 13. Fuel System Theory and Operation

### General Outcome:

- 13.0 The students should be able to describe the construction and operation of medium and heavy-duty diesel engine fuel systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 13.1 Describe the construction, including materials used in manufacture, of diesel fuel systems.
- 13.2 Describe the purpose and proper operation of diesel engine fuel systems and fuel system components including fuel injectors, fuel pumps, delivery valves, governors, fuel filters, fuel tanks, vents, caps, mounts, smoke limiters and engine management systems.

## Unit 14. Fuel System Diagnosis and Repair

### General Outcome:

- 14.0 The students should be able to perform maintenance, diagnosis and repair procedures on medium and heavy-duty diesel engine fuel systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 14.1 Perform routine maintenance procedures on diesel fuel systems according to manufacturers' recommendations.
- 14.2 Inspect, clean, test and measure, as appropriate, each fuel system components including fuel injectors, fuel pumps, delivery valves, governors, fuel filters, fuel tanks, vents, caps, mounts, smoke limiters and engine management systems.
- 14.3 Diagnose diesel engine fuel system problems.
- 14.4 Perform diesel engine fuel system repairs including removal, disassembly replacement and adjustment procedures.

## Unit 15. Engine Brake Theory and Operation

### General Outcome:

- 15.0 The students should be able to describe the construction and operation of diesel engine brake systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 15.1 Describe the construction, including materials used in manufacture, of engine brake systems.
- 15.2 Describe the purpose and proper operation of engine brakes and engine brake components including circuits, switches solenoids, valves, seals, screens lines and fittings.

## Unit 16. Engine Brake Diagnosis and Repair

### General Outcome:

- 16.0 The students should be able to perform maintenance, diagnosis and repair procedures on engine brakes systems.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 16.1 Perform routine maintenance and adjustment procedures on diesel engine brake systems, according to manufacturers' recommendations.
- 16.2 Inspect clean test and measure, adjust, as appropriate to all engine brake system components.
- 16.3 Diagnose engine brake system problems.
- 16.4 Perform engine brake system repairs, including removal disassembly, replacement and adjustment procedures.