

**Odessa College  
Technical Studies Division  
Industrial Engines and Transportation Maintenance  
Technology**

**Course Syllabus**

**COURSE NUMBER:** DEMR 1449 (Under NATEF review)  
**COURSE TITLE:** Diesel Engines II  
**CREDIT HOURS:** 4      **LECTURE HOURS:** 2      **LAB HOURS:** 6  
**PREREQUISITE:** DEMR1401, consent of department chair or instructor, Corequisite: DEMR 1406.

**CATALOG DESCRIPTION:**

An in-depth coverage of disassembly, repair, identification, evaluation, and reassembly of diesel engines. The students will learn the theory of operation, terminology and proper repair procedures through extensive lab and classroom instruction. Reading and interpretation of service material will be necessary to facilitate understanding, diagnosis and repair of the Caterpillar engine. Lab fee required. (SCANS 1, 3, 5, 6, 8, 9, 11) Prerequisite: Consent of department chair or instructor. Corequisite: DEMR 1406.

**COURSE LEARNING OUTCOMES:**

Identify engine components and their working relationship to the engine; evaluate engine components by inspection, testing, and/or measurement; and demonstrate disassembly and reassembly of the diesel engine.

**COMPETENCIES:**

After completing this course, the student should be able to demonstrate automotive competency in:

**I. DIESEL ENGINES**

**TEXTBOOK**

Classroom Manual: Automotive Brake Systems, Clifton E. Owen, 4<sup>th</sup> Edition, Thomson Delmar Learning, 2008

**SUPPLIES:**

Students will need course textbook, job sheets, paper, notebook, pen and pencils.

**COURSE GRADE EVALUATION:**

25% Professionalism (*A grade will be assessed using the following guide lines.*)  
Punctuality  
Desire to learn  
Appropriate appearance  
Quality workmanship  
Ability to work with others  
Safe working habits (*Students will be graded in all areas of shop safety.*)  
Positive attitude  
Work ethics  
Integrity  
Attendance  
25% Research Paper and/or Final Exam  
25% Lab Participation  
25% Quizzes and/or Daily

Also see instructor information sheet:

**ATTENDANCE POLICY:**

**YOUR** attendance is the greatest predictor of your success. **Student attendance at EVERY class is expected.** You should expect that each absence will adversely affect your course grade. Please see the instructor regarding anticipated absences or conflicts due to college sponsored activities.

**ACADEMIC ETHICS:**

You are expected to participate and contribute as a group in the labs and classroom; test will be taken without notes or other outside-assistance. If unethical behavior is detected, all parties involved will be denied credit for that project or exam. The questioned material and report of the ethics violation will be submitted to the department chair for further action if deemed necessary.

**STUDENT ASSISTANCE:**

- Admissions: 432-335-6443
- Book Store: 432-335-6654
- Cafeteria: 432-335-6435
- Career Services: 432-335-6835
- Cashier's: 432-335-6600
- Counseling: (Help center) 432-335-6346
- Auto/Diesel Department Chair: 432-335-6633
- .edu: (Student Service Center) 432-335-6833
- Financial Services: 432-335-6429
- Housing/Judicial Affairs: 432-335-6300
- Learning Resources Center: 432-335-6641
- Registrar: 432-335-6443
- Student Learning Center:
  - Peer tutoring available
  - PLATO: Computer tutoring available
  - (LRC 300) 432-335-6878
- Student Support Services: 432-335-6868
- Technical Studies Dean: 432-335-6686
- Testing Center: 432-335-6834
- Vice President Instruction: 432-335-6413
- Vice President for Student Services:
  - 432-335-6683
- Wi-Fi Java, Cyber Café: 432-335-6509

**FACULTY:**

James McCutcheon, chair;	Office Dm102	432-335-6633	<a href="mailto:jmccutcheon@odessa.edu">jmccutcheon@odessa.edu</a>
Jerry Griffith	Office Dm101	432-335-6632	<a href="mailto:jgriffith@odessa.edu">jgriffith@odessa.edu</a>
Perry Griffith	Office Dm105A	432-335-6603	<a href="mailto:pgriffith@odessa.edu">pgriffith@odessa.edu</a>

**LAB REQUIREMENTS:**

**General Shop Practices and Procedures**

- **Safety requirements will be strictly enforced: comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment, proper ventilation, and the handling, storage, and disposal of chemicals in accordance with local, state, and federal environmental regulations.**
- Proper **Personal Protection Equipment (PPE)** will be used in all required areas.
- **Safety Glasses** must be worn **at all times** in the **lab/shop area**. No exceptions!
- **Adhere to all Safety signs** posted on equipment, fire extinguishers, tool groups, vehicle lifts, support stands, grinders, drill presses, or any other equipment or areas marked with Safety signage.
- Do not restrict the passage of any marked walkway.
- **Safety is paramount** and you are responsible for your work area and your safe work habits! **Therefore, do not leave fluid spills on floor and keep your area free of clutter!**
- Equipment use is limited to those knowledgeable enough to operate the equipment safely; otherwise the equipment is **OFF LIMITS! (Consult your instructor)**.
- Tools and equipment **will not be loaned** or taken from the Odessa College premises.
- Students **MUST** sign out for any specialty tool needed and will only be issued by an instructor or designated person. The student will be **responsible for safety and care of those tools, when finished or at the end of each lab period**, return all tools to the checkout person so they can sign the tool back in.
- NATEF job sheets will be filled out for each lab assignment. When finished, give completed job sheets to the instructor and those will be recorded on your progress report.
- All vehicles are to be treated as customer vehicles. As a student **YOU ARE TO RESPECT THIS**, do not sit in, lean on, or handle any vehicle that has not been specifically assigned to you by your instructor.
- Any time a vehicle hood is open, fender covers must be in place on the fenders at all times.
- Students must get approval from the instructor **before** bringing vehicles in the shop. **Only certain vehicles qualify for NATEF required tasks.**
- Visitors are not allowed in the lab/shop area, however they may be escorted through the lab/shop area by approved personal.

**COURSE COMPETENCIES:**

**NATEF RECOMMENDED TASKS FOR INDUSTRIAL ENGINES AND TRANSPORTATION MAINTENANCE (DIESEL) TECHNOLOGY**

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment, proper ventilation, and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

**I. DIESEL ENGINES**

*For every task in Diesel Engines, the following task must be strictly enforced as a number 1 priority: Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment, and handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations, listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.*

**I.A General Engine Diagnosis**

Task	Job Sheet	Priority	
A.1	?	P1	Inspect fuel, oil, and coolant levels and condition; determine needed action.
A.2		P1	Diagnose causes of engine fuel, oil, coolant, air, and other leaks; determine needed action.
A.3		P2	Interpret engine noises; determine needed action.
A.4		P1	Observe engine exhaust smoke color and quantity; determine needed action.
A.5		P1	Perform air intake system restriction and/or pressure test; determine needed action.
A.6		P1	Perform manifold pressure (boost) tests; determine needed action.
A.7		P2	Perform exhaust back pressure tests; determine needed action.
A.8		P1	Perform crankcase pressure test; determine needed action-
A.9		P1	Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action.
A.10		P1	Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed action.
A.11		P2	Diagnose engine vibration problems; determine needed action.
A.12		P1	Check, record, and clear electronic diagnostic (fault) codes; monitor electronic data; determine needed action.
A.13		P3	Perform cylinder compression test; determine needed action.

**I.B Cylinder Head and Valve Train Diagnosis and Repair**

B.1	?	P1	Remove, clean, inspect for visible damage, and replace cylinder head(s) assembly.
B.2		P1	Clean and inspect threaded holes, studs, and bolts for serviceability; determine needed action.
B.3		P1	Inspect cylinder head and mating surfaces for warpage and thickness; inspect for cracks/damage; check condition of passages; inspect core and gallery plugs; determine needed action.
B.4		P3	Disassemble head and inspect valves, guides, seats, springs, retainers, rotators, locks, & seals; determine needed action.
B.5		P3	Measure valve head height relative to deck and valve face-to-seat contact; determine needed action.
B.6		P3	Inspect injector sleeves and seals; measure injector tip or nozzle protrusion; perform needed action.
B.7		P2	Inspect and adjust valve bridges (crossheads) and guides; perform needed action.
B.8		P3	Reassemble cylinder head.
B.9		P2	Inspect, measure, and replace/reinstall overhead camshaft; measure/adjust end play and backlash.
B.10		P2	Inspect pushrods, rocker arms, rocker arm shafts, and brackets for wear, bending, cracks, looseness, and blocked oil passages; perform needed action.
B.11		P2	Inspect cam followers; perform needed action.
B.12		P1	Adjust valve clearance.

**I.C Engine Block Diagnosis and Repair**

C.1	?	P3	Remove, inspect, service, and install pans, covers, vents, gaskets, seals, and wear rings.
C.2		P3	Disassemble, clean, and inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, core/expansion and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action.
C.3		P2	Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed action.
C.4		P3	Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed service.
C.5		P2	Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion).
C.6		P3	Inspect in-block camshaft bearings for wear and damage; determine needed action.
C.7		P3	Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play.
C.8		P2	Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passage(s); check passage plugs; measure journal diameter; determine needed service
C.9		P2	Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and adjust crankshaft end play.
C.10		P3	Inspect, install, and time gear train; measure gear backlash; determine needed action.
C.11		P2	Inspect connecting rods & bearings for wear patterns; measure pistons, pins, retainers, & bushings; perform needed action.
C.12		P2	Determine piston-to-cylinder wall clearance; check ring-to-groove clearance and end gap; install rings on pistons.
C.13		P2	Assemble pistons and connecting rods; install in block; install rod bearings and check clearances.
C.14		P2	Check condition of piston cooling jets (nozzles); determine needed action.
C.15		P2	Inspect and measure crankshaft vibration damper; determine needed action.
C.16		P3	Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s) and measure flywheel housing face and bore runout; determine needed action.
C.17		P3	Inspect flywheel/flexplate (includes ring gear) and mounting surfaces for cracks and wear, and measure runout; determine needed action.

**I.D Lubrication Systems Diagnosis and Repair**

D.1	?	P1	Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit; determine needed action.
D.2		P1	Check engine oil level, condition, and consumption; determine needed action.
D.3		P3	In Inspect and measure, oil pump, drives, inlet pipes, and screens; determine needed action.
D.4		P3	Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), and filters; determine needed action.
D.5		P3	Inspect, clean, test oil cooler components; determine needed action.
D.6		P2	Inspect turbocharger lubrication system; determine needed action.
D.7		P1	Determine proper lubricant and perform oil and filter change.

**I.E Cooling System Diagnosis and Repair**

**Task Job Sheet Priority**

E.1	?	P1	Check engine coolant type, level, condition, and consumption; determine needed action.
E.2		P2	Test coolant temperature and check operation of temperature sensor, and/or sending unit; determine needed action.
E.3		P1	Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment.
E.4		P2	Inspect thermostat, by-passes, housing(s), and seals; replace as needed.
E.5		P1	Test coolant for freeze protection and additive package concentration; adjust as needed.
E.6		P3	Recover, flush and refill with recommended coolant/additive package; bleed cooling system.
E.7		P1	Inspect coolant conditioner/filter, check valves, lines, and fittings; replace as needed.
E.8		P1	Inspect water pump and hoses; replace as needed.
E.9		P1	Inspect, clean, and pressure test radiator, pressure cap, tank(s) and recovery systems; determine needed action.
E.10		P2	Inspect thermostatic cooling fan (hydraulic, pneumatic and electronic) and fan shroud; replace as needed.

**I.F Air Induction and Exhaust Systems Diagnosis and Repair**

F.1	?	P2	Inspect turbocharger(s), waste gate and piping systems; determine needed action.
F.2		P1	Check air induction system: piping, hoses, clamps, and mounting; check for air restrictions and leaks; service or replace air filter as needed.
F.3		P2	Remove and reinstall turbocharger/wastegate assembly.
F.4		P3	Inspect intake manifold, gaskets, and connections; replace as needed.
F.5		P2	Inspect, clean, and test charge air cooler assemblies; replace as needed.
F.6		P2	Inspect exhaust manifold, piping, mufflers, and mounting hardware; repair or replace as needed.
F.7		P2	Inspect and test preheater/inlet air heater, or glow plug system and controls; perform needed action.
F.8		P3	Inspect and test exhaust gas recirculation (EGR) system; determine necessary action.

**I.G.1 General Diagnosis and Repair**

G.1.1	?	P1	Check fuel level, quality, and consumption; determine needed action.
G.1.2		P1	Inspect fuel tanks, vents, cap(s), mounts, screens, supply, crossover, and return lines and fittings; determine needed action.
G.1.3		P1	Inspect, clean and test fuel transfer (lift) pump, pump drives, screens, water separators, filters, heaters, and mounting hardware; determine needed action.
G.1.4		P1	Inspect & test low pressure regulator systems, check valves, pressure regulator valves, & restrictive fittings; determine needed action.
G.1.5		P1	Check fuel system for air; determine needed action; prime and bleed fuel system; check primer pump.

**I.G.2 Mechanical Fuel Injection Diagnosis and Repair**

G.2.1	?	P3	Perform on-engine inspections, tests, adjustments; check and adjust timing or replace and time a distributor (rotary) type injection pump; determine needed action.
G.2.2		P3	Perform on-engine inspections, tests, adjustments; check and adjust timing or replace and time an in-line type injection pump; determine needed action.
G.2.3		P3	Inspect and adjust throttle control systems; determine needed action.
G.2.4		P3	Inspect air/fuel ratio control systems; determine needed action.
G.2.5		P3	Inspect, test, and adjust engine fuel shut-down devices and controls; determine needed action.
G.2.6		P3	Inspect high pressure injection lines, hold downs, fittings and seals; replace as needed.

**I.G.3 Electronic Fuel Injection System Diagnosis and Repair**

G.3.1	?	P1	Inspect and test power and ground circuits and connections; measure and interpret voltage, voltage drop, amperage, and resistance readings using a digital multimeter (DMM); determine needed action.
G.3.2		P1	Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic diagnostic equipment and tools (to include PC based software and/or data scan tools); determine needed action.
G.3.3		P2	Locate and use relevant service information (to include diagnostic procedures, flow charts, and wiring diagrams).
G.3.4		P1	Inspect and replace electrical connector terminals, seals, and locks.
G.3.5		P2	Inspect and test switches sensors, controls, actuator components, and circuits; adjust or replace as needed.
G.3.6		P1	Using recommended electronic diagnostic tools (to include PC based software and/or data scan tools), to access and change customer parameters.
G.3.7		P1	Inspect, test, and adjust electronic unit injectors (EUI); determine needed action.
G.3.8		P2	Remove and install electronic unit injectors (EUI) and related components; recalibrate ECM (if applicable).
G.3.9		P1	Perform cylinder contribution test utilizing recommended electronic diagnostic tool.
G.3.10		P1	Perform engine timing sensor calibration (if applicable).
G.3.11		P1	Perform on-engine inspections and tests on hydraulic electronic unit injectors and system electronic controls; determine needed action.
G.3.12		P2	Perform on-engine inspections and tests on hydraulic electronic unit injector high pressure oil supply and control systems; determine needed action.
G.3.13		P2	Perform on-engine inspection & tests on distributor-type injection pump electronic controls; determine needed action.
G.3.14		P2	Perform on-engine inspections and tests on in-line type injection pump electronic controls; determine needed action.
G.3.15		P3	Perform on-engine inspections and tests on common rail type injection systems; determine needed action.

**I.H Engine Brakes**

I.H.1	?	P3	Inspect and adjust engine compression /exhaust brakes; determine needed action.
I.H.2		P3	Inspect, test, & adjust engine compression /exhaust brake control circuit, switche, & solenoid; repair/replace as needed.
I.H.3		P3	Inspect engine compression/exhaust brake housing, valves, seals, screens, lines, and fittings; repair or replace as needed.