

# Grays Harbor College

## AUTOMOTIVE TECHNOLOGY AUTO 213: Advance Engine Performance/HVAC 16 Credits Denis Samson, Instructor

### Course syllabus, Spring

Associate in Technology Degree

**Prerequisite Requirements:**

Placement in MATH 60, ENGLISH 60, and Instructor permission.

<u>Core Courses</u>	<u>Credits</u>
AUTO 111            Brakes / Suspension / Steering	16
AUTO 112            Electrical / Electronics / ABS	16
AUTO 113            Engines / Electrical / Tune-up / Ignition	16
AUTO 211            Power Train / Transmissions (Manual and Automatic)	16
AUTO 212            Fuel Systems / Electronic / Computer Controls	16
<b>AUTO 213</b> <b>Advanced Engine Performance / Air Conditioning / Heating</b>	<b>16</b>

Credits Required            **96**

**Support Courses**

WELD	101	Related Welding 1	6
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Credits Required            **6**

**General Education Courses**

ENGL	101	Expository / Argumentative Writing	5
		<b>Or</b>	
ENGL	150	Vocational / Technical / Business Writing	5
MATH	100	Vocational / Technical Math (or higher)	5
PSYCH	100	General Psychology	5
		<b>Or</b>	
PSYCH	106	Applied Psychology	3
		<b>Or</b>	
SOC	101	Introduction to Sociology	5

Credits Required            ~~13~~ **15**

**Elective Courses**

AUTO	224	Work Experience	1-5
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Elective Courses must be approved by the student's academic advisor at Grays Harbor College

~~Minimum Credits Required~~            ~~116+~~  
**3 PE Credits**

See Grays Harbor College Catalog or GHC web page at [www.ghc.edu](http://www.ghc.edu) for Course Outlines for Automotive Certificate of Completion and Automotive Certificate of Achievement Program.

## **I. COURSE DESCRIPTION:**

*Prerequisite: CPT in Math 60, English 60 and Instructor permission.*

The foundation for Automotive Technology provided in this course includes a study of safety rules and procedures, use of shop tools, equipment, engine performance, and HVAC testing procedures currently use by the automotive industry. This course is an advanced study of the equipment that is used in diagnosing the modern automobile. This course will include the use of diagnostic equipment such as current industry engine analyzers, lab scopes, scanners, multi-gas analyzers and various meters and sensor testers. This course will study the principles of refrigeration, and the heating and air conditioning systems currently used by the automotive industry, including manual, semi-automatic, and automatic systems. The course will include details of the electrical control circuits for the compressor, blower, and coolant fan(s). The description, purpose and function of air conditioning system components are explained in this course. Service and repair procedures will be presented and practiced by the student. Safety procedures for handling R-12 and 134-A are discussed. 8 lecture hours; 16 lab hours. Vocational program course. May be used as a general elective in the AA degree.

## **II. COURSE OBJECTIVES**

To meet the course standards and demonstrate the ability to meet the outcomes expectations of this course (Competency in the discipline (4 CD), Literacy (2 L), Critical Thinking (3 CT), Social and Personal responsibility (4 SP), and Information Used (4 IU)] student will:

Demonstrate employability by following safe work practices, being on time, maintaining proper attendance, and properly following written and oral instruction (SP)

Demonstrate safety and proper work habit (CD, SP)

Meet NATEF competency criteria in the following areas:

- 1) Identify engine analyzers and describe their purpose. (L, CT)
- 2) Identify lab scopes and describe their purpose. (L, CT)
- 3) Identify meters and describe their purpose. (L, CT)
- 4) Diagnose automotive engine problems using engine analyzers. (CD, CT, SP, IU)
- 5) Diagnose electronic problems using lab scopes. (CD, CT, SP, IU)
- 6) Diagnose automotive electrical problems using meters. (CD, CT, SP, IU)
- 7) List safety precautions in handling refrigerant-12/134-A. (L, SP)
- 8) Trace the flow of Refrigerant-12/134-A through the automotive A/C system. (L, CT)
- 9) Describe basic operation of each component in the typical automotive A/C system. (L, CT)
- 10) Describe the different types of automotive air conditioning systems. (L, CT)
- 11) Identify the different types of compressors and controls. (CD, L, IU)
- 12) Use the manifold gauge set in discharging, evacuating, and charging automotive A/C systems. (CD, SP, IU)
- 13) Detect leaks using both propane torch and electronic leak detectors. (CD, IU)
- 14) Check oil level in the compressor. (CD, IU)
- 15) Repair refrigerant lines. (CD, IU)
- 16) Diagnose and troubleshoot system. (CD, CT, IU)
- 17) Identify the types of compressors used on modern vehicles. (L, CT)

### **III. INSTRUCTIONAL TECHNIQUE**

AUTO 111 is taught 4 hours and 5 minutes per day, plus one 15 minute break, Monday – Friday, for a period of about 11 weeks. The methods of instruction will be lecture, discussion, classroom exercises, demonstrations, and lab work. There will be eight hours per week for lecture presentations and sixteen hours per week hands on in the lab/shop experience. Lab/shop work is emphasized with small groups and one to one instruction when possible.

### **IV. DISABILITES**

If you have a documented disability that may interfere with your ability to fully participate in this class, you may be eligible for accommodations. Contact your instructor or the Disability Support Services located on campus in the Student services, room 119. Information regarding any disability will be kept confidential.

### **V. WORK HABITS**

Industry has expressed attendance, punctuality, and general work habits as critically important for success on the job. The standards of this course include industry expectations. If you want to do well, the following will have to occur: show up **every day**, be on time, clean, fed, wide awake and thinking about automotive, with neatly and correctly completed homework ready to turn in. When class starts...participate! Keep safety first. Treat equipment with respect. Be conscientious and considerate of others. Make productive use of the time available. Clean up after yourself. Feel good about yourself, your work, and your progress.

Efficient use of time is vital. The Automotive Competency Lists are designed to require effective time management for successful completion. Just like on the job, you can expect to have to plan out your tasks and periodically work on two or more competencies simultaneously to avoid unnecessary delays waiting for a special tool or for shared equipment.

This is a full-time training program. The main goal is to build technical and workplace skills. The quantity and skill level requirements of the Automotive Competency Lists and homework, combined with the strict enforcement of work habits standards, grading criteria, and shop rules, is intended to maximize your likelihood of success in the industry. Focus, a “can-do” attitude, and prioritization of your education is both expected and necessary in order to be successful.

### **VI. HOME WORK**

Regular Assignments: To be handed in daily.

Processed in Microsoft Word.

Times New Roman, 12 point font, double-spaced, 1 ¼” margins and at least 14 lines in length.

More than **1** mistake or ANY mistake on heading: lose 3 points off your work habits point sheet.

Basic Chapters (1-2-3-4-5-6-7) will be discussed in class.

You will be given a complete homework schedule for the entire quarter.

In case of an absence, all homework that is required will be due from you the day you return.

**VII. ATTENDANCE POLICY.**

Attendance is graded. There are no excused absences. You are expected to be present every day for the entire quarter. Lost points cannot be made up. If a problem arises that will cause you to miss enough class to fail the course, see admissions to request an official withdrawal.

If you will miss class for some reason, please call or tell a friend or family member to call and leave a message on the shop answering machine by 7:00 a.m. An absence with **prior** notice by 7:00 a.m. of the day absent will score 0 points for the day. An absence **without** prior notice by 7:00 a.m. of the day absent will score -5 for the day.

**TARDINESS / LEAVING EARLY**

Arriving after 9:30 or leaving before 9:45 is an absence. Whatever the case, notify the Instructor or the Instructor Aid as soon as you arrive or immediately before you leave.

**VIII. “A” TEAM**

Automotive Technicians earning 3 consecutive “A’s” in the 16 credit core automotive courses will be inducted into the A Team. A Team members will be awarded the coveted gray hat and be included in the annual spring A team photo.

**IX. METHOD OF EVALUATION**

Students will earn two grades in this course, a work habits point sheet grade, and a shop/competency/participation grade. The **Lower** of the two letter grades earned is the overall grade earned.

**Work Habits Points Sheets Grade:**

Attendance, Punctuality, and Time Card, Tags,  
Homework Assignments handed in on time, (see work habits point sheet),  
Final Exam (written 10% and practical test 90%) and also chapter exams.

**Point Schedule:.....Daily Total .....5 points**

<u>Homework not handed on time</u>	<b>Lose 3 points per day.</b>
<u>Homework with more than 1 mistake</u>	<b>Lose 3 points per day.</b>
<u>Homework with incorrect heading</u>	<b>Lose 3 points per day.</b>
<u>Late Homework not handed in the next day</u>	<b>Lose 3 points per day.</b>
<u>Inaccurately filling time card</u>	<b>Lose 1 point per mistake.</b>
<b><u>Chapter test below 80%</u></b>	<b>Lose 3 points</b>
<u>Final Exam below 80%</u>	<b>Lose 1 grade (ex: A to B)</b>
<u>Unauthorized use of a cell phone or texting</u>	<b>Lose 3 points each time.</b>

**Shop / Competency / Participation Grade:**

Competency completed and signed by you and me. In order to get a competency signed, the work order needs to be completed and closed.  
Correctly complete work orders and include the task with the work order when required by the competency.

**This percentage is based on work habits points, and competencies collected during the quarter. The Chapter and Final exams can not be repeated. Students not present for any exam will be given a zero.**

<b>Auto 111</b>	<b>MINIMUM REQUIREMENTS FOR GRADE OF</b>			
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
Work Habits Points	94%	90%	85%	80%
Competency	90%	80%	70%	70%

**\*If you have a course grade below C more than once, you will be on probation by the administration.\***

Pluses and minus will not be used. In addition, grade will also be lowered by one full letter if you are awarded and accept a local scholarship, but **FAIL** to attend the donor recognition ceremony in the spring: Ex: If you finish the class with “B”, you will get a “C”.

**X. CLEAN UP PROCEDURE**

Clean up starts when signaled. You may clean up early if you desire, but you will be docked points same as for leaving early.

Final grade computed will be lowered by one full letter if absent on the last day of class (shop clean up day). Arriving late or leaving early is the same as not being here that day.

**XI. ATTENDANCE POLICY**

**NAME:** \_\_\_\_\_

**GHC Automotive Technology – WORK HABITS POINT SHEET**

Circle present week:        1   2   3   4   5   6   7   8   9   10   11   12

5 points are possible per day. Deduct 3 points for arriving late, leaving early. Deduct 3 points for not turning in completed homework at the time it is collected or if there is more than 1 mistakes or late homework not supplied the next day. Deduct 1 point for inaccurately filling out the time card. 5 points will be deducted (for you) if you are sent home, **inaccurately** record your points for the day, or take an unauthorized break. **An absence is equal to 0 points.** When failing a test 3 point must be deducted even if it mean going below 0. Leaving tag(s) in tool room after returning a tool(s) -1. Points cannot be made up.

Day	Points earned	Explanation if less than 5 points	Tags Tools -1	Test -3	Home work -3	Time card -1	Cell Phone or texting -3
M							
T							
W							
Th							
F							

Total points earned as of last week: \_\_\_\_\_  
 (Monday)

Points earned this week: + \_\_\_\_\_  
 (Friday)

Total points earned to date: = \_\_\_\_\_      Total points possible \_\_\_\_\_  
 (Friday) Adding wrong cost= **5 points**                      (Monday)

Total points earned today divided by total points possible = \_\_\_\_\_ %  
 (Friday)

Current work habits letter grade (Friday): \_\_\_\_\_

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>Work Habits Point Grade</b>	<b>94%</b>	<b>90%</b>	<b>85%</b>	<b>80%</b>
Competency Point Grade	90%	80%	70%	70%

\_\_\_\_\_  
 Student Signature

\_\_\_\_\_  
 Instructor Signature

(The **lower** of the two grades earned is the highest possible grade for the quarter. Additional requirement apply – see syllabus.)

## XII. **HOMEWORK EXAMPLE**

Name \_\_\_\_\_ Course: AT213 Date: \_\_\_\_\_

Chapter 51

Pages Covered 1354 to 1358

Welcome to Grays Harbor College Automotive Technology program. During this quarter we will have morning lecture and lab time. We will have test and a final exam. First thing in the morning I will pick up your home work. During the lecture I will perform experiments with instructional tools and cut away equipment. In the lab you will be working on variety of cars: Chevrolet, Ford, Volvo, Hyundai and many more. These cars are available to allow you to develop and improve your working skill by diagnosing and removing and installing components. There is a wide variety of tools available to you thru the use of tags. The lab will have to be kept clean and you will have to wear coverall and make good use of fender cover in order to keep the cars clean. You will find this course very challenging and instructive. My Instructor Aid and I will be in the lab giving information to help you understand what you are doing but we will not do the work for you. As a student you will have to retrieve information about the task you are performing on a specific car from our computer. After each task you will sign a competency and I will sign it too, then you will be able to continue other tasks. During this quarter you will have to be here before the class starts and you will have to participate by being here every day. You will learn to use a time clock, write work orders and learn good work habits.

**Note: Filling the heading incorrectly will result in -3 on your points sheet.**

Requirements: margin 1 ¼, **font 12(Time New Roman)**, double space, 14 lines minimum,  
-3 points if there are more than 1 mistake.

**XIII. COURSE OUTLINE:**

**A. INTRODUCTION/SAFETY**

1. Purpose and scope of course
2. Safety

**B. EQUIPMENT**

1. Engine Analyzer
  - a. Connections
  - b. Operation
  - c. Modes
  - d. Test Procedures
  - e. Emissions
  - f. Looking up specifications
  - g. Computer Diagnosing
2. Scanners
  - a. Programming
  - b. Adapters
  - c. Cartridges
  - d. Menu
  - e. Sub-Menu
  - f. Modes of Operation
3. Lab Scope
  - a. Purpose
  - b. Scales
  - c. Voltage
  - d. Time
4. Meters
  - a. Purpose
  - b. Scales
    - 1) Voltage A/C & D/C
    - 2) Amperage A/C & D/C
    - 3) Resistance
    - 4) Diode Check
    - 5) Impedance

**C. AUTOMOTIVE AIR CONDITIONING FUNDAMENTALS**

1. Heat and Temperature Molecular motion Heat transfer
  - a. Latent heat
  - b. Measuring the quantity of heat
  - c. Medium of heat transfer
2. Relationship Between Pressure and Boiling Point
  - a. Compressing a gas
  - b. Concentrating heat

D. PRINCIPLES OF REFRIGERATION

1. Basic Refrigeration Circuit
2. Evaporator
3. Compressor
  - a. Variable V-5
  - b. Scroll compressor
  - c. Piston type compressor
4. Condenser
5. Thermostatic Expansion Valve
  - a. Internally equalized
  - b. Externally equalized
  - c. Capillary tube
  - d. Remote bulb
6. Suction Throttling Valve
7. Evaporator Pressure control (POA) Valve
8. Refrigerant
  - a. Handling refrigerant
  - b. Refrigeration oil
9. Special Safety Precautions

E. BASIC AUTOMOTIVE AIR CONDITIONING SYSTEM

1. Cycling Clutch System
  - a. Adjustable and (non) adjustable thermostatic switches
  - b. Cycling clutch system with thermostatic expansion valve
  - c. Cycling clutch with orifice tube (CCOT)
2. Evaporator Pressure Control System
  - a. Pilot operated absolute (POA) valve
  - b. Valves in receiver (VIR)
  - c. Suction throttling valve (STV)
3. Compressors
  - a. General Motors 4 cylinder compressor (R)4
  - b. General Motors DA 6 compressor
  - c. General Motors V5 compressor
  - d. Compressor controls
    - 1) compressor clutch and pulley assembly
4. Receiver/Dehydrator
5. Accumulator
6. Expansion Tube (orifice)
7. Thermostatic Switch
8. Pressure Cycling Switch
9. Manually Operated controls
10. Ambient Switch
11. Thermal Limiter and Superheat Switch
12. Discharge Pressure Switch (Low) Pressure (Cut-Off)
13. Water Control Valve
14. Muffler

F. SYSTEM SERVICE

1. Precautions in Handling R-12
2. System Service Valves
  - a. Stem type service valves
  - b. Schrader type service valves
3. Manifold Gauge Set
4. Discharging, Evacuating, and Charging System
5. Performance Testing
6. Leak Testing
  - a. Dye leak detector
  - b. Electronic leak detector
7. Compressor Oil Level Check
8. Refrigerant Line Repairs
9. Thermostatic Switch replacement

G. DIAGNOSIS AND TROUBLESHOOTING

1. Use of Manifold Gauge Set for Diagnosis
2. Use of Sight Glass for Diagnosis
3. Use of Thermometer for Diagnosis
4. Thermostatic Expansion Valve (TXV)
5. CCOT Orifice POA or Suction Throttling Valve

H. ENGINE PERFORMANCE

1. Tune up, component diagnose and testing, Compression test
2. Timing Belt
3. Electronic fuel injection fine tuning component

**XIV. INSTRUCTIONAL MATERIALS, SUPPLIES, AND EQUIPMENT:**

The student will provide:

1. Textbooks
2. Notebook and composition book for journal
3. Pencils, **pens**, and colored markers as needed
4. Personal hand tools: see required tool list
5. Safety glasses
6. Disposable gloves...nitrile, not latex (latex dissolves easily in the chemicals we use)

**XV. TEXTBOOKS: REQUIRED**

Various textbooks are used based on current editions of manuals and published textbooks. Please see your instructor for current textbook required.

The instructor will provide:

1. Selections from Service Manuals and Electronic Service Manuals
2. Other handouts as required

Note: Coveralls are supplied to all students (special lab fee).

I have received and read the syllabus for AUTO 213 for Spring Quarter. I acknowledge this by my signature below.

Print Name	Signature	Date
1 _____	_____	_____
2 _____	_____	_____
3 _____	_____	_____
4 _____	_____	_____
5 _____	_____	_____
6 _____	_____	_____
7 _____	_____	_____
8 _____	_____	_____
9 _____	_____	_____
10 _____	_____	_____
11 _____	_____	_____
12 _____	_____	_____
13 _____	_____	_____
14 _____	_____	_____
15 _____	_____	_____
16 _____	_____	_____