AT R114: ADVANCED ENGINE PERFORMANCE

Originator
kevin_corse1

College
Oxnard College

Discipline (CB01A)
AT - Automotive Technology

Course Number (CB01B)
R114

Course Title (CB02)
Advanced Engine Performance

Banner/Short Title
Advanced Engine Performance

Credit Type
Credit

Start Term
Spring 2021

Formerly
AT R014 - Advanced Engine Performance
AT R014L - Advanced Engine Performance Lab

Catalog Course Description
This advanced course provides technical preparation in the skills required to diagnose engine control management systems of modern vehicles. The L-1 certification by ASE requires the most current knowledge and preparation in the series of tests offered by ASE for automobiles. Students will use manufacturer approved scan tools, lab scopes, digital volt meters and other state-of-the-art test equipment. Systems covered will include the engine management computer control, and other computer control systems (such as the anti-lock brake and supplemental restraint computer systems) and how they interact. Preparation for the ASE L-1 certification in advanced engine performance will be included.

Taxonomy of Programs (TOP) Code (CB03)
0948.00 - *Automotive Technology

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
B (Transferable to CSU only)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
C - Clearly Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
May be required

Grading method
Letter Graded

Alternate grading methods
Credit by exam, license, etc.

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
87.5
Maximum Contact/In-Class Lecture Hours
87.5

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
140
Total Maximum Contact/In-Class Hours
140

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
175
Maximum Outside-of-Class Hours
175

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
315
Total Maximum Student Learning Hours
315

Minimum Units (CB07)
6
Maximum Units (CB06)
6

Prerequisites
AT R113

Entrance Skills
Entrance Skills
Students should be familiar with computerized engine controls.

Prerequisite Course Objectives
AT R113-Identify safety hazards in an automotive shop.

AT R113-Identify emission system components.
AT R113-Identify electronic engine management computer sensors and actuators.
AT R113-Use a flow chart to successfully repair emission failure vehicles

Requisite Justification
Requisite Type
Prerequisite

Requisite
AT R113

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Content review

Student Learning Outcomes (CSLOs)

Upon satisfactory completion of the course, students will be able to:

1	Students are able to Identify safety hazards and avoid harm to themselves and others. Students donn and doff PPE and properly and identify PPE equipment.
2	Demonstrate their ability to identify, retrieve, comprehend and apply basic automotive technical information including but not limited to online information.
3	Indicate power, ground, switched power, switched ground, and varying voltage wires on three wiring diagrams using color markers or crayons
4	Comprehend and explain simple graphing concepts as they apply to automotive diagnosis and repair.
5	Correctly determine a vehicle has reached proper operating temperature.

Course Objectives

Upon satisfactory completion of the course, students will be able to:

1	Identify safety hazards in an automotive shop.
2	Describe and demonstrate proper customer relations.
3	Identify fault code descriptions from computer information systems.
4	Perform the proper steps to calibrate shop diagnostic equipment.
5	Demonstrate the operation of closed-loop and open-loop operation.
6	Demonstrate the difference between OBD-1, OBD-2 and CAN computer systems.
7	Identify and test electronic engine management computer sensors and actuators.
8	Explain and demonstrate the direct ignition (DI) and distributor-less ignition (DIS) systems.
9	Explain and demonstrate how computer controlled emission system components work.
10	Explain and demonstrate data link connector (DLC) identification and location.

Course Content

Lecture/Course Content
Textbook related information.
1. Introduction and Basic Theory
   a. Review of on-board computer systems
   b. Data link connector (DLC) terminal identification
   c. Retrieving trouble codes
   d. Clearing trouble codes
   e. Flow chart diagnostics for trouble codes
2. Computer Control Systems
   a. GM computer control system
   b. Toyota computer control system
   c. Honda computer control system
   d. Ford computer control system
   e. Chrysler computer control system
   f. Other manufacturer computer control system
   g. OBD 1 operation
   h. OBD 2 operation
   i. CAN monitors operation
   j. Sensors and actuators
3. Electronic Fuel Control Management Systems

    a. Electric fuel pumps
    b. Electronic fuel Injectors
    c. Injector spray patterns
    d. Sequential fuel injection
    e. Fuel trim interpretation
    f. Fuel system pressure testing

4. Evaporative Emission Control
    a. Visual inspection
    b. Testing the system for leaks
    c. Bidirectional scan tool controls
    d. Identification of fault codes
    e. Proving the evaporative system after repair

5. Computer Controlled Air Injection and Exhaust Gas Systems
    a. Exhaust gas system
    b. Air injection system
    c. Catalytic converter system

6. Vehicle Computers Communication
    a. P code series
    b. B code series
    c. C code series
    d. U code series
    e. Repairing the vehicle with multiple fault codes
    f. Repairing the vehicle without fault codes
    g. Drive cycles
    h. Proving the repair

Laboratory or Activity Content

Hands on Labs will be required.

The lab activities will include the completion of specific ASE Task sheets required by accreditation. Many of the labs are listed here but change yearly.

1. Work Order Form
2. OBD II trouble Codes
3. OBD II Connector ID
4. OBD Connector ID #2
5. Retrieving OBD II DTC's
6. DMM Use
7. Measure Voltage w/DMM
8. Measure Amperage w/DMM (>10A)
9. Check Circuit w/DMM
10. Test Light Usage
11. Fused Jumper Circuit Test
12. Key-Off Battery Drain
13. Jump Starting
14. Ignition System ID
15. Spark Plug Specifications
16. Ignition Timing setting and checking
17. Electronic Ignition Diagnosis
18. Ignition Scope Analysis
19. Ignition Inspection & Testing
20. Spark Plug Inspection
21. Ignition Coil Test
22. CKP/CMP Sensor
23. CKP/CMP Sensor Waveform
24. Primary Ignition Inspect & Test
25. First Things First (x6) Credit x 2

26. Gasoline Engine ID
27. ECT Sensor DMM
28. Temp Sensor Scan Tool
29. TPS DMM
30. TPS DSO/GMM
31. TPS Voltmeter (10/90 Rule)
32. TPS Scan Tool
33. TPS Resistance Test
34. MAP DMM Test
35. MAF Sensor Diagnosis
36. MAF Scope
37. O2 Sensor Diagnosis
38. Wide Band O2 Sensor
39. Fuel Trim Diagnosis
40. Exhaust Analysis
41. Engine Noise/Vibration Diag.
42. Exhaust/Sound Diag.
43. Vacuum Testing
44. Paper Test
45. Cylinder Power Balance
46. Compression Test (2 Vehicles)
47. Cylinder Leak Down Test
48. Verify Engine Operating Temp
49. Cooling System Inspect
50. Verify Cam/Crank Time (T belt)

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Skills demonstrations
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Group projects
Laboratory activities
Objective exams
Oral presentations
Problem-solving exams
Skills demonstrations
Skill tests

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Audio-visual presentations
Class activities
Class discussions
Case studies
Distance Education
Demonstrations
Field experience/internship
Field trips
Guest speakers
Instructor-guided use of technology
Lecture

Describe specific examples of the methods the instructor will use:

The use of technology in the classroom will be video, web based training, online training and group work with students presenting information in class. Quizzes will be administered and reviewed in each class session..

1. Reading assignments: Textbook-reading assignments will be discussed in class to assist students with understanding about the duties of an engine performance technician.
2. Lecture presentation on engine performance diagnosis and testing procedures.
3. Use of demonstration boards: Showing how systems work with sensors and actuators.
4. Use of "role play" demonstrations: Showing how technicians should logically repair vehicles.

Representative Course Assignments

Writing Assignments
1. Students will be required to answer questions at the end of each chapter. All tests will include essay-type questions.
2. Students will write repair orders and document repair instructions and procedures.
3. Students will practice speaking to a consumer writing down what the consumer wishes to repair.
4. Students will write a detailed description of repair procedures.

Critical Thinking Assignments
Students will be assigned an engine performance problem or senario. Students must locate the information and data needed to properly diagnose and engine performance problem.Students will access online manuals and engine data using computer interface. Hand held Scan tools and tablets will be provided.

Reading Assignments
1. Students will be required to do outside reading in professional journals such as Motor Service Journal and Motor Age Magazine.
2. Students will be expected to visit internet websites such as the State of California Bureau of Automotive Repair and Department of Consumer Affairs
3. Students will watch web based training and determine course of action.
4. Students will look up BLS statistics and determine income producing job data.

Skills Demonstrations
Lab activities. Hands on practice in automotive setting. Task sheets require demonstration of computer, lab scope, graphing and data interpretation.

Use of industry equipment and tools hands on demonstration.

Students will demonstrate proper use and care of equipment and tools.

Other assignments (if applicable)
1. Laboratory assignments: The student will use an automotive shop equipment to inspect, identify and assist in performing vehicle computer system inspections.
2. Laboratory assignments: The student will use shop manuals, computer information systems such as Alldata and Mitchell (available in classroom computers) and other references needed in the diagnosis and repair of complicated computer management systems.
3. Quizzes and examinations on course content including but not limited to closed loop and open-loop operation, listing the difference between OBD-1, OBD-2, and CAN systems, and summarizing the difference between direct-ignition and distributor-less ignition systems.
4. Students can enroll for smog technician inspector at course end.
5. ASE certification is encouraged.

Outside Assignments

Representative Outside Assignments
1. Students will be required to answer questions at the end of each chapter. All tests will include essay-type questions.
2. Students will be required to do outside reading in professional journals such as Motor Service Journal and Motor Age Magazine.
3. Students will be expected to visit internet websites such as the State of California Bureau of Automotive Repair and Department of Consumer Affairs
4. Students will be required to earn online Safety certification and other industry related certifications.

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Classic Textbook
No

Description
Halderman (2018). Advanced Engine Performance Diagnosis (6th/e). Prentice Hall.

Resource Type
Textbook

Classic Textbook
No

Description
Halderman (2018). Worktext for Advanced Engine Performance Diagnosis (6th/e). Prentice Hall.

Resource Type
Other Instructional Materials

Description
CDX Preferred Automotive MAST - A8: Engine Performance, First Edition (2020)1-Year

Library Resources

Sufficient Library Resources exist
Yes

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.
Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.
Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes
E-mail	E-mail, class announcements and various learning management system tools such as "Message Students Who" and "Assignment Comments", will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.

Face to Face (by student request; cannot be required)	Students will have direct face-to-face contact with instructor during weekly class meetings. This time will provide the opportunity for students to discuss and ask questions about the material to facilitate student learning objectives and course outcomes. The instructor will also hold weekly, scheduled office hours for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form "study groups" in person or online. Note: For hybrid classes, face-to-face class time will provide opportunities for students to discuss amongst themselves (in groups or pairs) and ask questions about the material to facilitate SLOs and course outcomes.
Other DE (e.g., recorded lectures)	Faculty may use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: Recorded Lectures, Narrated Slides, Screencasts. Instructor created content. OC Online Library Resources o Canvas Peer Review Tool. Canvas Student Groups (Assignments, Discussions) 3rd Party (Publisher) Tools (MyOpenMath) o Websites and Blogs o Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)
Synchronous Dialog (e.g., online chat)	Instructor may provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
E-mail	E-mail, class announcements and various learning management system tools such as "Message Students Who" and "Assignment Comments", will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
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Other DE (e.g., recorded lectures)	Faculty may use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: o Recorded Lectures, Narrated Slides, Screencasts o Instructor created content o OC Online Library Resources o Canvas Peer Review Tool o Canvas Student Groups (Assignments, Discussions) o 3rd Party (Publisher) Tools (MyOpenMath) o Websites and Blogs o Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)
Synchronous Dialog (e.g., online chat)	Instructor may provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
E-mail	E-mail, class announcements and various learning management system tools such as "Message Students Who" and "Assignment Comments", will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
Face to Face (by student request; cannot be required)	The instructor will hold weekly, scheduled office hours either in person or via-web conferencing, for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form "study groups" in person or online.
Other DE (e.g., recorded lectures)	Faculty will use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: o Recorded Lectures, Narrated Slides, Screencasts o Instructor created content o OC Online Library Resources o Canvas Peer Review Tool o Canvas Student Groups (Assignments, Discussions) o 3rd Party (Publisher) Tools (MyOpenMath) o Websites and Blogs o Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)
Synchronous Dialog (e.g., online chat)	Instructor will provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.
Telephone	Students can request for instructor to call or vice versa in order to answer one-on-one questions about course material or student progress.

Examinations

Hybrid (1%–50% online) Modality
Online
On campus

Hybrid (51%–99% online) Modality
Online
On campus

Primary Minimum Qualification
AUTOMOTIVE TECHNOLOGY

Review and Approval Dates

Department Chair
12/02/2020

Dean
12/02/2020

Technical Review
12/09/2020

Curriculum Committee
12/09/2020

DTRW-I
MM/DD/YYYY

Curriculum Committee
MM/DD/YYYY

Board
MM/DD/YYYY

CCCCO
MM/DD/YYYY

Control Number
CCC000611489

DOE/accreditation approval date
MM/DD/YYYY