AT R102: INTRODUCTION TO ALTERNATIVE FUEL SYSTEMS

Originator
kevin_corse1

College
Oxnard College

Discipline (CB01A)
AT - Automotive Technology

Course Number (CB01B)
R102

Course Title (CB02)
Introduction to Alternative Fuel Systems

Banner/Short Title
Intro Alternative Fuel Systems

Credit Type
Credit

Start Term
Fall 2022

Catalog Course Description
This course covers the theory of operation, installation, testing, trouble-shooting, and repair of vehicles powered by gaseous fuels with a focus on Compressed Natural Gas (CNG) as well as an introduction to Liquefied Natural Gas (LNG). Both dedicated and after-market systems will be covered. Gasoline and diesel powered vehicles are discussed with an emphasis on computer-controlled fuel injection. Components are thoroughly examined in this course to include everything from storage up to the injector(s). Successful completion of this course will prepare students for the CNG Inspector's Certification.

Taxonomy of Programs (TOP) Code (CB03)
0948.40 - *Alternative Fuels and Advanced Transportation 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
(L) Letter Graded

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
43.75
Maximum Contact/In-Class Lecture Hours
43.75

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
26.25
Maximum Contact/In-Class Laboratory Hours
26.25

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
70
Total Maximum Contact/In-Class Hours
70

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
87.5
Maximum Outside-of-Class Hours
87.5

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
AT R100

Entrance Skills

Entrance Skills
Identify and use hand tool and automotive equipment safely and properly when performing minor repairs to automotive systems.

Prerequisite Course Objectives
AT R100-Demonstrate the precautions personal and shop safety procedures needed to safely work with high voltage systems.
AT R100-Demonstrate familiarity with reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in battery system troubleshooting.
AT R100-Demonstrate familiarity with reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in battery system troubleshooting.
AT R100-Demonstrate how to perform basic maintenance related to hybrid and electric vehicles.
AT R100-Demonstrate how to diagnose a basic hybrid or electric vehicle fault using standard diagnostic equipment.

Requisite Justification

Requisite Type
Prerequisite

Requisite
AT R100

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Required communication/computation skill

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Locate and evaluate each of the system components and fuel storage modules available for alternative fuels.
2	Observe system tests and complete standard testing.
3	Complete safe start and shut down of fuel and electrical systems.
4	Identify and practice with industry safety tools, accurately describe safety protocols.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Differentiate between the types of alternatively fueled systems.
2	Analyze the proper installation of each system.
3	Examine the proper operation of each fuel system.
4	Assess the effects of various systems on computer controlled vehicles.
5	Perform leak-test procedures on various systems.
6	Evaluate and test various system repair procedures.
7	Analyze various troubleshooting techniques for a variety of common problem failures.
8	Assess the various federal, state, and regulatory agency rules for specific vehicle installations.

Course Content

Lecture/Course Content

I. Introduction to Alternative Fuel Systems
A. Types of systems
B. Comparisons of each system's advantages and disadvantages
C. Latest developments in industry regarding alternative fuels.
II. Natural Gas Systems
A. History of natural gas
B. Characteristics of natural gas
1. comparing natural gas to gasoline
C. Advantages of natural gas
1. emissions
2. performance
3. engine wear
4. safety
D. Disadvantages of natural gas
1. performance
2. safety
III. Operational Theory of Natural Gas Systems
A. Dedicated natural gas systems
1. OEM systems
a. components
b. operation
c. troubleshooting
2. Aftermarket systems
a. components
b. operation
c. troubleshooting
B. Dual-fuel systems
1. OEM systems
a. components
b. operation
c. troubleshooting
2. Aftermarket systems
a. components
b. operation
c. troubleshooting
IV. Installation of CNG Systems
A. Regulations

1. NFPA 52 regulation
B. Safety considerations
C. Component installation
1. tanks
2. regulators
3. electrical components
4. valves
V. Maintenance of Natural Gas Equipped Vehicles
A. System maintenance
B. Engine maintenance
VI. Electronic Fuel Injection Engine Controls
A. Computer operation on EFI vehicles
1. Inputs
a. types
b. operational theory
2. outputs/actuators
a. types
b. operational theory
B. Diagnosis of EFI systems
1. trouble code diagnosis
2. service modes
C. Interrelationship of EFI alternative fuel systems
1. dedicated systems
a. inputs
b. outputs and actuators
2. dual fuel systems
a. inputs
b. outputs and actuators
3. EFI engine control "fixes"
VII. Diesels and Natural Gas Systems
A. dedicated systems
B. after market systems
C. electronic engine controls
D. differences as compared to gasoline systems
E. installation
F. troubleshooting

Laboratory or Activity Content

I. Introduction to Alternative Fuel Systems
A. Types of systems
B. Comparisons of each system's advantages and disadvantages
C. Latest developments in industry regarding alternative fuels.
II. Natural Gas Systems
A. History of natural gas
B. Characteristics of natural gas
1. comparing natural gas to gasoline
C. Advantages of natural gas
1. emissions
2. performance
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D. Disadvantages of natural gas
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III. Operational Theory of Natural Gas Systems
A. Dedicated natural gas systems
1. OEM systems
a. components
b. operation
c. troubleshooting
2. Aftermarket systems
a. components
b. operation
c. troubleshooting
B. Dual-fuel systems
1. OEM systems
a. components
b. operation

c. troubleshooting
2. Aftermarket systems
a. components
b. operation
c. troubleshooting
IV. Installation of CNG Systems
A. Regulations
1. NFPA 52 regulation
B. Safety considerations
C. Component installation
1. tanks
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V. Maintenance of Natural Gas Equipped Vehicles
A. System maintenance
B. Engine maintenance
VI. Electronic Fuel Injection Engine Controls
A. Computer operation on EFI vehicles
1. Inputs
a. types
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B. Diagnosis of EFI systems
1. trouble code diagnosis
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C. Interrelationship of EFI alternative fuel systems
1. dedicated systems
a. inputs
b. outputs and actuators
2. dual fuel systems
a. inputs
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3. EFI engine control "fixes"
VII. Diesels and Natural Gas Systems
A. dedicated systems
B. after market systems
C. electronic engine controls
D. differences as compared to gasoline systems
E. installation
F. troubleshooting

Methods of Evaluation

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

Written expression
Problem solving exercises
Skills demonstrations

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):

Individual projects
Objective exams
Problem-solving exams
Quizzes
Skills demonstrations
Written homework

Instructional Methodology

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

Class activities
Class discussions
Demonstrations
Distance Education

Instructor-guided use of technology
Laboratory activities
Lecture
Problem-solving examples
Small group activities

Describe specific examples of the methods the instructor will use:

1. Lectures will be given on each topic in the listed content. The lectures will make the concepts understandable, meaningful, and emphasize key points as they relate to Alternative Fuel Systems. The emphasis of the lectures will focus on Alternative Fuel Systems and research industry and government agencies discussions.
2. Instructors will perform various demonstrations related to alternative fuel systems.
3. Instructor will provide working guidance to students working in small groups to practically apply course content through various activities which align with the course content. Witten and hands on activities where appropriate.
4. Using tools and equipment related to subject, demonstrate and have students practice using the same or similar tools. Students may collaborate or be broken into small groups to complete designated skill tasks.

Representative Course Assignments

Writing Assignments

1. Written homework will be assigned for every content module in the course. The assignment will come from the course textbook and lecture.

Critical Thinking Assignments

1. Written homework will cover the questions at the end of each chapter and responses should be accurate, reflective of the use of critical thinking, and complete.

Reading Assignments

1. Students are required to read chapters within their textbook and comprehend manufacturer's technical data sheets.
2. Students will be required to read articles in an industry related journals, or magazines of their choosing and write short excerpts on the piece.

Skills Demonstrations

1. Students will have lab assignments based on course content, and have to perform according to NATEF (National Automotive Technicians Education Foundation) standards and procedures. Class performance will be evaluated as to safety and acceptable industry standards,

Outside Assignments

Representative Outside Assignments

1. Students are required to read chapters within their textbook and comprehend manufacturer's technical data sheets.
2. Students will be required to read articles in an industry related journals, or magazines of their choosing and write short excerpts on the piece.
3. Written homework will be assigned for every content module in the course. The assignment will come from the course textbook and lecture.

Articulation

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
Long Beach City College	AUTO 271	Intro to Alternative Fuel Systems	3

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

Course is CSU transferable
Yes

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

Area F: Ethnic Studies

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
ASE F1 Prep Guide, Delmar Cengage Learning. 2014

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (1%–50% 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: o Recorded Lectures, Narrated Slides, Screencasts o Instructor created content o VC 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.

Examinations

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

Primary Minimum Qualification
AUTOMOTIVE TECHNOLOGY

Review and Approval Dates

Department Chair
10/22/2021

Dean
10/26/2021

Technical Review
MM/DD/YYYY

Curriculum Committee
10/27/2021

DTRW-I
10/28/2021

Curriculum Committee
12/08/2021

Board
12/14/2021

CCCCO
01/26/2022

Control Number
CCC000629203

DOE/accreditation approval date
MM/DD/YYYY