AUTO 042B: AUTOMOTIVE MECHATRONICS

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Co-Contributor(s)

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Justification / Rationale
This new course will enhance the learner's essential skills for employment and advancement within the automotive service industry. Autonomous vehicles are operating on the roads today and there is a need for a skilled workforce. This course is essential to update the College automotive program curriculum to reflect industry needs.

Effective Term
Fall 2022

Credit Status
Credit - Degree Applicable

Subject
AUTO - Automotive Technology

Course Number
042B

Full Course Title
Automotive Mechatronics

Short Title
AUTOMOTIVE MECHATRONICS

Discipline

Disciplines List
Automotive Technology

Modality
Face-to-Face
Hybrid

Catalog Description
This course provides the learners with the proper mindset and skills to service today's vehicles. The internal combustion motor is no longer the heart of vehicles, it is the electrical system. Vehicles are moving from a mechanical focused to an electrical focus. Automotive mechatronics will focus on the synergy between the mechanical, computer, software, and electrical systems of today's vehicle.

Schedule Description
Automotive mechatronics will focus on the synergy between the mechanical, computer, software, and electrical systems of today's vehicle. Prerequisite: AUTO-011B or concurrent enrollment.

Lecture Units
2
Lecture Semester Hours
36

Lab Units
1
Lab Semester Hours
54

In-class Hours
90

Out-of-class Hours
72

Total Course Units
3
Total Semester Hours
162

Prerequisite Course(s)
AUTO 011B or concurrent enrollment

Required Text and Other Instructional Materials

Resource Type
Web/Other
Open Educational Resource
No

Year
2021

Description
Instructor hand-outs and manufacturer materials.

Resource Type
Book
Open Educational Resource
No

Author
Reif, Konrad (Editor)

Title
Automotive Mechatronics

Edition
1st

City
Germany

Publisher
Springer Vieweg

Year
2015

College Level
Yes

Flesch-Kincaid Level
13

ISBN #
978-3658039745

For Text greater than five years old, list rationale:

This is the definitive text on the subject for a technician level learner.

Class Size Maximum

21

Entrance Skills

Electrical system familiarization.

Requisite Course Objectives

AUTO 011B-Identify and interpret electrical/electronic system concern; determine necessary action.

Entrance Skills

Ability to measure ignition-off draw.

Requisite Course Objectives

AUTO 011B-Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.

Entrance Skills

Advanced driver assist system familiarization.

Requisite Course Objectives

AUTO 011B-Describe autonomous vehicle operation and the various Advanced Driver Assist Systems (ADAS) that are employed during autonomous driving.

Course Content

1. Basics of mechatronics
   a. Systems and components
   b. Future outlook
   c. Integration of computer, electrical, and mechanical engineering.
2. Electronic control units
   a. Design
   b. Data processing
   c. Control software
   d. Computer relationship to sensors and software
3. Networking
   a. Topology
   b. Automotive networking
   c. Vehicle examples
4. Automotive Bus
   a. CAN
   b. LIN
   c. Bluetooth
   d. 5G
5. Safety
   a. First-aid, rescuing a coworker
   b. Fuel-cells
   c. High Voltage (HV) batteries, inverters, capacitors
   d. Facility/work area safety
   e. Tools and meters
   f. Personal protection equipment (PPE)
6. Sensors

    a. Classification/types
    b. Automotive applications
    c. Sensor relationship to computer and software
7. Actuators
    a. Classification/types
    b. Automotive applications
    c. Actuator relationship to computer and software
8. Advanced driver assist systems (ADAS)
    a. Overview
    b. Classification/types
9. Automotive artificial intelligence (AI)
    a. Description
    b. Ethics
10. Automotive industry workforce
    a. Jobs
    b. Required skills
    c. Future of automotive mechatronics

Lab Content
1. Shop and vehicle safety
2. Electrical review
    a. Circuits
    b. Terms
    c. Principles
3. Programming automotive computers
    a. Basic programming principles
    b. Basic Python
4. Group activity involving building a scale vehicle
    a. Mindstorms
5. Scan tool and service information activities
    a. Sensors
    b. Actuator
    c. Computer control logic
6. Automotive Buses
    a. CAN
    b. Gateway modules
    c. LIN
7. Flash reprogramming
8. Automotive manufacturer web-based training

Course Objectives

	Objectives
Objective 1	Describe shop and vehicle safety procedures when working on a modern vehicle.
Objective 2	Develop a diagnostic process for a coolant temperature sensor.
Objective 3	Describe and analyze bus circuit diagnosis.
Objective 4	Describe and evaluate steps to program a computer.
Objective 5	Evaluate normal and abnormal sensor operation using a scan tool.
Objective 6	Flash reprogram a vehicle computer.
Objective 7	Evaluate normal and abnormal actuator operation using a scan tool.
Objective 8	List basic electrical circuits, terms, and malfunctions.
Objective 9	Discuss the ethical issue with using artificial intelligence on a vehicle.

Student Learning Outcomes

	Upon satisfactory completion of this course, students will be able to:
Outcome 1	Explain how the modern vehicle has transitioned from engine centered to electrical centered.
Outcome 2	Describe the interaction on a modern vehicle between the mechanical, computer, electrical and software.
Outcome 3	Demonstrate the automotive mechatronics principles by building and programming a functional scale-down vehicle.

Methods of Instruction

Method	Please provide a description or examples of how each instructional method will be used in this course.
Discussion	Provide feedback during discussions and active involvement in assignments.
Collaborative/Team	Respectful, active interaction in group activities.
Technology-based instruction	Use of state-of-the-art scan tools, service information, equipment and virtual reality.
Participation	Provide feedback during discussions and active involvement in assignments.
Lecture	Lectures will stimulate discussion and learning on theoretical and knowledge-based material.
Laboratory	Perform assigned laboratory tasks involving vehicles, equipment, and service information.

Methods of Evaluation

Method	Please provide a description or examples of how each evaluation method will be used in this course.	Type of Assignment
Written homework	Course related homework assigned after each session.	In and Out of Class
Student participation/contribution	Provide feedback during discussions and active involvement in assignments.	In and Out of Class
Mid-term and final evaluations	Cumulative midterm and final with a hands-on portion related to course material.	In and Out of Class
Group activity participation/observation	Respectful, active interaction in group activities related to courses material.	In and Out of Class
Laboratory projects	The lab activities will require hands-on, live or simulated vehicle in a live or simulated setting.	In Class Only
Tests/Quizzes/Examinations	Periodic quizzes related to course material.	In and Out of Class

Assignments

Other In-class Assignments

1. Participate in discussions.
2. Start assigned group presentations.
3. Quizzes.
4. Exams.
5. Take notes from lecture.

Other Out-of-class Assignments

1. Complete assigned reading from text and other material.
2. Homework from the text.
3. Complete assigned group presentations.
4. Create a course-related presentation.
5. Take-home test.
6. SP2 safety tests.
7. Automotive manufacturer web-based training.

Grade Methods
Letter Grade Only

Distance Education Checklist

Include the percentage of online and on-campus instruction you anticipate.

Online %
50
On-campus %
50

Lab Courses

How will the lab component of your course be differentiated from the lecture component of the course?
The lab activities require hands-on, live vehicles or equipment. There is physical interaction with the vehicles and the learner based on service procedures and required equipment.

How will you assess the online delivery of lab activities?
Laboratory activities will not be delivered in the online setting, only in person.

Instructional Materials and Resources

If you use any other technologies in addition to the college LMS, what other technologies will you use and how are you ensuring student data security?
None.

Effective Student/Faculty Contact

Which of the following methods of regular, timely, and effective student/faculty contact will be used in this course?

Within Course Management System:
Discussion forums with substantive instructor participation
Online quizzes and examinations
Regular virtual office hours
Timely feedback and return of student work as specified in the syllabus
Video or audio feedback
Weekly announcements

External to Course Management System:
Direct e-mail
Synchronous audio/video

Briefly discuss how the selected strategies above will be used to maintain Regular Effective Contact in the course.
Regular effective contact will be practiced through online lecture, discussion board postings, email communications, regular announcements, prompt grading and feedback of assignments, and virtual office hours. This contact between the facilitator and learner on a regular basis will enhance learner confidence and understanding and promote critical thinking and analyzation of subject matter.

Other Information

Provide any other relevant information that will help the Curriculum Committee assess the viability of offering this course in an online or hybrid modality.
With the uncertainty of the teaching environment, enabling the lecture portion of this course to be delivered in an online setting, while keeping the hands-on portion face-to-face, will ensure learners can access needed training to ensure knowledge and experience is achieved to gain employment in the automotive field.

MIS Course Data

CIP Code
47.0614 - Alternative Fuel Vehicle Technology/Technician.

TOP Code
094840 - Alternative Fuels and Advanced Transportation Technology

SAM Code
B - Advanced Occupational

Basic Skills Status
Not Basic Skills

Prior College Level
Not applicable

Cooperative Work Experience
Not a Coop Course

Course Classification Status
Credit Course

Approved Special Class
Not special class

Noncredit Category
Not Applicable, Credit Course

Funding Agency Category
Not Applicable

Program Status
Program Applicable

Transfer Status
Transferable to CSU only

General Education Status
Y = Not applicable

Support Course Status
N = Course is not a support course

Allow Audit
Yes

Repeatability
No

Materials Fee
No

Additional Fees?
No

Approvals

Curriculum Committee Approval Date
3/17/2022

Academic Senate Approval Date
3/24/2022

Board of Trustees Approval Date
4/22/2022

Chancellor's Office Approval Date
05/02/2022

Course Control Number
CCC000631328