A. **TITLE:** HYBRID AND ELECTRIC VEHICLES

B. **COURSE NUMBER:** AUTO 240

C. **CREDIT HOURS:** (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)

   # Credit Hours: 3
   # Lecture Hours: 2 per week
   # Lab Hours: 2 per week
   Other: per week

   Course Length: 15 Weeks

D. **WRITING INTENSIVE COURSE:** Yes ☑️ No ☐

E. **GER CATEGORY:** None: ☐ Yes: GER
   *If course satisfies more than one: GER*

F. **SEMESTER(S) OFFERED:** Fall ☑️ Spring ☐ Fall & Spring ☐

G. **COURSE DESCRIPTION:**

This course covers the details and diagnosis of the powertrain of hybrid vehicles that are electric and internal combustion engine propelled as well as vehicles that are electric propulsion only. The internal combustion engine is not covered in this course. Coverage in this course includes safety, tools, scan tools, types, and diagnostic procedures primarily focusing on the electric portion of vehicle drivetrains.

H. **PRE-REQUISITES:** None ☐ Yes ☑️ If yes, list below:

   AUTO 113, 114, 141, 144 or ASE Certification with 4 years of automotive experience, or instructor's permission.

   **CO-REQUISITES:** None ☐ Yes ☐ If yes, list below:
I. **STUDENT LEARNING OUTCOMES:** *(see key below)*

By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Student Learning Outcome [SLO]</th>
<th>Program Student Learning Outcome [PSLO]</th>
<th>GER [If Applicable]</th>
<th>ISLO &amp; SUBSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify safe practices with high-voltage components</td>
<td>ALO4</td>
<td>5-Ind, Prof, Disc, Know Skills ISLO ISLO</td>
<td>None None Subsets Subsets</td>
</tr>
<tr>
<td>Apply the use of high-voltage tools and equipment necessary to perform testing of hybrid and electric vehicles.</td>
<td>ALO3</td>
<td>5-Ind, Prof, Disc, Know Skills ISLO ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
</tr>
<tr>
<td>Describe the fundamentals of motor generator operation and voltage storage.</td>
<td>ALO2</td>
<td>5-Ind, Prof, Disc, Know Skills ISLO ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
</tr>
<tr>
<td>Evaluate data to devise a diagnostic plan to repair components in the high-voltage vehicle system.</td>
<td>ALO1</td>
<td>5-Ind, Prof, Disc, Know Skills ISLO ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
</tr>
</tbody>
</table>

*Gereral Education Requirements (GER)*

- ISLO
- Subsets
<table>
<thead>
<tr>
<th>KEY</th>
<th>Institutional Student Learning Outcomes [ISLO 1 – 5]</th>
<th>ISLO &amp; Subsets</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISLO #</td>
<td><strong>Communication Skills</strong>&lt;br&gt;Oral [O], Written [W]</td>
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<tr>
<td>1</td>
<td><strong>Critical Thinking</strong>&lt;br&gt;Critical Analysis [CA], Inquiry &amp; Analysis [IA], Problem Solving [PS]</td>
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<tr>
<td>2</td>
<td><strong>Foundational Skills</strong>&lt;br&gt;Information Management [IM], Quantitative Lit./Reasoning [QTR]</td>
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<td>3</td>
<td><strong>Social Responsibility</strong>&lt;br&gt;Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</td>
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<tr>
<td>4</td>
<td><strong>Industry, Professional, Discipline Specific Knowledge and Skills</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Include program objectives if applicable. Please consult with Program Coordinator*
J. **APPLIED LEARNING COMPONENT:** Yes ☒ No ☐

If YES, select one or more of the following categories:

- [x] Classroom/Lab
- [ ] Internship
- [ ] Clinical Placement
- [ ] Practicum
- [ ] Service Learning
- [ ] Community Service
- [ ] Civic Engagement
- [ ] Creative Works/Senior Project
- [ ] Research
- [ ] Entrepreneurship
  (program, class, project)

K. **TEXTS:**


L. **REFERENCES:**

ShopKeyPro

M. **EQUIPMENT:** None ☐ **Needed:** hybrid and electric vehicles, coated tools, UL certified rubber and leather gloves

N. **GRADING METHOD:** A-F

O. **SUGGESTED MEASUREMENT CRITERIA/METHODS:**

Tests, homework, and lab performance

P. **DETAILED COURSE OUTLINE:**

I. **Safety**
Utilize safe practices in relation to high-voltage electrical circuits with insulated tools and certified clothing.

II. **Introduction to high-voltage tools**

III. **Charging Stations: Apps and type**

IV. **Hybrid Types**
   A. Series
   B. Parallel
C. Series-Parallel

V. Electric Motors Generators
A. Motor Operation
B. Power Generation.
C. Motor Generator Management

VI. Batteries
A. Identification of battery types and locations
B. AC charging stations

VII. Cooling and Heating Systems
A. Battery Cooling
B. Heat Pumps
C. Air Conditioning

VIII. Scan Tool Operation
A. PIDS
B. Component Testing

Q. LABORATORY OUTLINE: None ☐ Yes ☑

I. Safety
Utilize safe practices in relation to high-voltage electrical circuits with insulated tools and certified clothing.

II. Introduction to high-voltage tools: Common tools, Megaohm meter, safety hook

III. Charging Stations: Nevaldine Inspection with visiting vehicle

IV. Hybrid Types: Inspection of visiting vehicles.

V. Electric Motors Generators
A. Motor Operation
B. Power Generation.
C. Motor Generator Management with scan tool.

VI. Batteries
A. Identification of battery types and locations
B. AC charging stations, including those provided with vehicle
C. Removal and individual cell charging.

VII. Cooling and Heating Systems
A. Battery Cooling
B. Heat Pumps
C. Air Conditioning

VIII. Scan Tool Operation
A. PIDS: cell block, temperature, torque management
B. Component Testing
C. Actuator management
D. Repair diagnosis