# Purdue University

**Request for Adding/Revisions**

**Department:** Mechanical Engineering  
**Effective Session:** Fall 2020

**Instructions:** Please check the items below which describe the purpose of this request.

- New course with supporting documents
- Add existing course offered at another campus
- Expiration of a course
- Change in course title
- Change in course number
- Change in course credit/type
- Change in course attributes (department head signature only)
- Change in instructional hours
- Change in course description
- Change in course requisites
- Change in semesters offered (department head signature only)
- Transfer from one department to another

## Proposed

- **Subject Abbreviation:** ME  
- **Course Number:** 44000  
- **Long Title:** Automotive Prime Movers: Green Engines and Clean Fuels  
- **Short Title:** Green Eng/Clean Fuel

## Existing

- **Subject Abbreviation:** ME

## Terms Offered

- **Check All That Apply:**
  - Summer
  - Fall
  - Spring
  - Campus/ES Involved:
    - Calumet
    - Fort Wayne
    - Indianapolis
    - N. Central
    - Tech Statewide
    - W. Lafayette

## Credit Type

<table>
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<tr>
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<th>Minutes</th>
<th>Meetings</th>
<th>% of Credit</th>
<th>Delivery Method</th>
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<tr>
<td>Laboratory</td>
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<td>1</td>
<td>16</td>
<td>Live</td>
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<td>Prep</td>
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<td>Practice</td>
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<td>Clinic</td>
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<td>Ind. Study</td>
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<td>Pract/Observ</td>
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## Course Attributes

- Pass/No Pass Only
- Satisfactory/Unsatisfactory Only
- Repeatable
- Maximum Repeatable Credit:
- Credit by Examination
- Designator Required
- Special Fees
- Registration Approval Type
- Instructor
- Department

## Course Description (Include Requisites):

**ME 44000 Automotive Prime Movers: Green Engines/Clean Fuels**

Sem. 2, Class 2, Lab 1, Cr. 3

Prerequisite: ME 30000

Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICEs topics - engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression-ignition. HE topics - different components of hybrid engines and the powertrain design. FCE topics - fundamentals of fuel cells and automotive applications. Clean fuel topics - biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels. Course includes a laboratory component.

## Cross-Listed Courses

<table>
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<tr>
<th>Cross-Listed Course</th>
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## Department Head Signatures

- **Calumet Department Head:** Date  
- **Calumet School Dean:** Date  
- **Fort Wayne Department Head:** Date  
- **Fort Wayne School Dean:** Date  
- **Indianapolis Department Head:** Date  
- **Indianapolis School Dean:** Date  
- **North Central Chancellor:** Date  
- **West Lafayette Department Head:** Date  
- **West Lafayette College/School Dean:** Date  
- **West Lafayette Registrar:** Date

**Office of the Registrar**

**Received 2011 Aug 11 AM 10:27**
ME 44000 Automotive Prime Movers: Green Engines/Clean Fuels
Sem. 2, Class 2, Lab 1, Cr. 3
Prerequisite: ME 30000

Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICE topics - engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression/ignition. HE topics - different components of hybrid engines and the powertrain design. FCE topics - fundamentals of fuel cells and automotive applications. Clean fuel topics - biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels. Course includes a laboratory component.
ME 44000 Automotive Prime Movers: Green Engines and Clean Fuels
Sem. 2, Class 2, Lab 1, Cr. 3
Prerequisite: ME 30000

Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICEs topics - engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression-ignition. HE topics - different components of hybrid engines and the powertrain design. FCE topics - fundamentals of fuel cells and automotive applications. Clean fuel topics - biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels. Course includes a laboratory component.

Date: 10/12/2011
Calumet Department Head
Calumet School Dean

Fort Wayne Department Head
Fort Wayne School Dean

Indianapolis Department Head
Indianapolis School Dean

Central Department Head
North Central Chancellor

West Lafayette Department Head
West Lafayette College/School Dean

WEST LAFAYETTE REGISTRAR

OFFICE OF THE REGISTRAR
TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Mechanical Engineering

RE: ME 44000 Changes in Course Title, Description, and prerequisites

The Faculty of the School of Mechanical Engineering has approved the following change in ME 44000. This action is now submitted to the Engineering Faculty with a recommendation for approval.

From:

ME 44000 Internal Combustion Engines
Sem. 1, Class 2, Lab 1, cr. 3
Prerequisite: ME 30000, ME 31500


To:

ME 44000 Automotive Prime Movers: Green Engines and Clean Fuels
Sem. 2, Class 2, Lab 1, cr. 3
Prerequisite: ME 30000

Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICEs topics - engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression-ignition. HE topics - different components of hybrid engines and the powertrain design. FCE topics - fundamentals of fuel cells and automotive applications. Clean fuel topics - biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels. Course includes a laboratory component.

Reason: To update the focus of this course to include a broader emphasis on new engine technologies such as hybrid engines, fuel-cell engines, and clean fuels.

James D. Jones, Associate Professor and Associate Head
School of Mechanical Engineering

APPROVED FOR THE FACULTY OF THE SCHOOLS OF ENGINEERING BY THE ENGINEERING CURRICULUM COMMITTEE

ECC Minutes #10
Date 2/1/2011
Chairman ECC R. Cipra
ME 44000
Automotive Prime Movers: Green Engines and Clean Fuels

Course Outcomes [Related ME Program Outcomes in brackets]

1. Relate processes in automotive prime movers to engineering fundamentals [A1, A2, A3, A4]
2. Study low-carbon emitting, and LEV, ULEV, SULEV, PZEV, and ZEV prime mover designs [A2, A3, A4, A5, A6, A7]
3. Study prime mover designs that are alternatives to conventional combustion engines [A2, A3, A4, A5, A6, A7]
4. Study cleaner alternatives to conventional fossil fuels. [A1, A2, A3, A4]
5. Carry out analysis of prime mover designs and fuel alternatives to identify cost and energy tradeoffs [A2, A3, A5, A6, A7]

Motivation/Performance Parameters (1 wk)

1. Classification of prime movers, vehicles
2. Performance parameters of prime movers

I.C. Engines (4 wks)

1. Clean diesels
2. DISI engines
3. HCCI engines
4. Alternate designs
5. Aftertreatment

Hybrid and Fuel Cell Engines (5 wks)

2. Hybrid system design and integration with vehicles.
3. Fundamental of PEM fuel cells
5. Integration with vehicles

Clean Fuels (3 wks)

1. Fuel chemistry and heating values
2. Fossil fuels, including natural gas
3. Hydrogen
4. Biofuels: sources, production, utilization

Cost and Energy Balance (2 wks)

1. Well-to-wheel analysis methodologies
2. Well-to-wheel analysis of alternate engine designs, including fuels
3. Estimates of life-cycle emissions
4. Cost analysis of alternate engine designs

Laboratory Experiments

1. Engine tear-down and re-assembly (2 weeks)
2. Spark-ignition engine performance with gasoline and gasoline/ethanol blends (2 weeks)
3. Compression-ignition engine performance with diesel and biodiesel (2 weeks)
4. Hybrid engine component performance and comparison with I.C.e engine (2 weeks)
5. Fuel cell performance (1 week)
6. Hybrid engine system arrangements (1 week)
7. Impact of driving cycle on hybrid engine performance (1 week)

Revision Date:
May 14, 2010
<table>
<thead>
<tr>
<th>COURSE NUMBER:</th>
<th>ME 44000</th>
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<tbody>
<tr>
<td>REQUIRED COURSE OR ELECTIVE COURSE:</td>
<td>Elective</td>
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<tr>
<td>TEXTBOOK/REQUIRED MATERIAL:</td>
<td>Class notes</td>
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<tr>
<td>COORDINATING FACULTY:</td>
<td>J. Abraham</td>
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<tr>
<td>COURSE DESCRIPTION:</td>
<td>Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICEs topics - engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression-ignition. HE topics - different components of hybrid engines and the powertrain design. FCE topics - fundamentals of fuel cells and automotive applications. Clean fuel topics - biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels. Course includes a laboratory component.</td>
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<td>ASSESSMENTS TOOLS:</td>
<td>Six homework assignments</td>
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<td>Ten laboratory reports.</td>
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<td>Project report and presentation</td>
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<td>Mid-semester exam.</td>
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<td>One comprehensive final exam.</td>
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<td>PROFESSIONAL COMPONENT:</td>
<td>Engineering Topics: Engineering Science – 2.50 credits (83%)</td>
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<td>Engineering Design – 0.50 credits (17%)</td>
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<td>NATURE OF DESIGN CONTENT:</td>
<td>Problems of a design nature are included in the laboratory and project assignments. Examples are: evaluation of the impact of hybrid designs on fuel economy, design of driving cycles to minimize fuel consumption for hybrids, and integration of fuels and engine designs to minimize emissions and reduce fuel consumption. Class project involves student proposals for new green engine designs.</td>
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<td>COMPUTER USAGE:</td>
<td>Computer usage is required for some laboratory problems.</td>
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<td>COURSE STRUCTURE/SCHEDULE:</td>
<td>Lecture – 2 meetings per week at 50 minutes.</td>
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<td>Lab – 1 meeting per week at 110 minutes</td>
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<tr>
<td>PREPARED BY:</td>
<td>J. Abraham</td>
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<td>REVISION DATE:</td>
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<th>COURSE TITLE:</th>
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<td>TERMS OFFERED:</td>
<td>Spring</td>
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<tr>
<td>PRE-REQUISITES:</td>
<td>ME 30000</td>
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<td>[Related ME Program Outcomes in brackets]:</td>
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<td>Carry out analysis of prime mover designs and fuel alternatives to identify cost and energy tradeoffs [A2, A3,A5,A6,A7]</td>
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| RELATED ME PROGRAM OUTCOMES: | |
| A2. | Engineering fundamentals |
| A3. | Analytical skills |
| A4. | Experimental skills |
| A5. | Open-ended design & problem solving skills |
| A6. | Multidisciplinary within and beyond engineering |
| A7. | Integration of analytical, problem solving, & design skills |