Office of the Registrar
FORM ~~40 REV. 9/06~~

PURDUE UNIVERSITY

~~REQUEST FOR ADDITION, EXPIRATION,~~
OR REVISION OF AN UNDERGRADUATE COURSE
(100-400 LEVEL)

45-10

DEPARTMENT: Mechanical Engineering

EFFECTIVE SESSION: ~~Fall 2009~~ 20120

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

- [ ] 1. New course with supporting documents
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [x] 5. Change in course title
- [ ] 6. Change in course credit/type
- [ ] 7. Change in course attributes (department head signature only)
- [ ] 8. Change in instructional hours
- [x] 9. Change in course description
- [x] 10. Change in course requisites
- [ ] 11. Change in semesters offered (department head signature only)
- [ ] 12. Transfer from one department to another

PROPOSED:		EXISTING:	
Subject Abbreviation		Subject Abbreviation	ME
Course Number		Course Number	44000

Long Title: Automotive Prime Movers: Green Engines and Clean Fuels

Short Title: Green Eng/Clean Fuel

Abbreviated title will be entered by the Office of the Registrar if omitted. (22 CHARACTERS ONLY)

TERMS OFFERED
Check All That Apply:
- [ ] Summer
- [ ] Fall
- [x] Spring

CAMPUS(ES) INVOLVED
- [ ] Calumet
- [ ] Cont Ed
- [ ] Ft. Wayne
- [ ] Indianapolis
- [ ] N. Central
- [ ] Tech Statewide
- [x] W. Lafayette

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range:
   Minimum Cr. Hrs
   (Check One) To ☐ Or ☐
   Maximum Cr. Hrs
3. Equivalent Credit: Yes ☐ No ☐
4. Thesis Credit: Yes ☐ No ☐

COURSE ATTRIBUTES: Check All That Apply
1. Pass/Not Pass Only ☐
2. Satisfactory/Unsatisfactory Only ☐
3. Repeatable ☐
   Maximum Repeatable Credit: ☐
4. Credit by Examination ☐
5. Designator Required ☐
6. Special Fees ☐
7. Registration Approval Type
   Department ☐ Instructor ☐
8. Variable Title ☐
9. Remedial ☐
10. Honors ☐
11. Full Time Privilege ☐
12. Off Campus Experience ☐

Instructional Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated	Delivery Method (Asyn. Or Syn.)	Delivery Medium (Audio, Internet, Live, Text-Based, Video)
Lecture	50	2	16		Syn.	Live
Recitation						
Presentation						
Laboratory	110	1	16		Syn.	Live
Prep						
Jio						
Distance						
Clinic						
Experiential						
Research						
Ind. Study						
Pract/Observ						

Cross-Listed Courses

OFFICE OF THE REGISTRAR
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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.

	Date		Date
Calumet Department Head		Calumet School Dean	
Fort Wayne Department Head		Fort Wayne School Dean	
Indianapolis Department Head		Indianapolis School Dean	
North Central Department Head		North Central Chancellor	
West Lafayette Department Head: James D. Jones	2/20/201	West Lafayette College/School Dean: [signature]	7/25/11
		West Lafayette Registrar: [signature]	10/30/11

OFFICE OF THE REGISTRAR

10/27/11

ME 44000

45-10

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FORM 40 REV. 9/06

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Course Number		Course Number	44000
Long Title	Automotive Prime Movers: Green Engines and Clean Fuels		
Short Title	Green Eng/Clean Fuel		

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   (Check One) To [ ] Or [ ]
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2. Satisfactory/Unsatisfactory Only [ ]
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Laboratory	110	1	16		Syn.	Live
Lab Prep						
Studio						
Distance						
Clinic						
Experiential						
Research						
Ind. Study						
Prac/Observ						

Cross-Listed Courses

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RECEIVED
2011 AUG 11 AM 10:27
OFFICE OF THE REGISTRAR

COURSE DESCRIPTION (INCLUDE REQUISITES):

ME 44000 Automotive Prime Movers: Green Engines/Clean Fuels
Sem. 2, Class 2, Lab 1, Cr. 3
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Calumet Department Head	Date	Calumet School Dean	Date
Fort Wayne Department Head	Date	Fort Wayne School Dean	Date
		Wanda L Worley	8/23/11
Indianapolis Department Head	Date	Indianapolis School Dean	Date
North Central Department Head	Date	North Central Chancellor	Date
James D. Jones	2/20/201		7/25/11
West Lafayette Department Head	Date	West Lafayette College/School Dean	Date
			10/30/11
		West Lafayette Registrar	Date

OFFICE OF THE REGISTRAR

45 ME 44000

PURDUE UNIVERSITY

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DEPARTMENT: Mechanical Engineering

EFFECTIVE SESSION: ~~Fall 2009~~ 20120

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TERMS OFFERED (Check All That Apply): [ ] Summer [ ] Fall [x] Spring

CAMPUS(ES) INVOLVED: [ ] Calumet [ ] Cont Ed [ ] Ft. Wayne [ ] Indianapolis [ ] N. Central [ ] Tech Statewide [x] W. Lafayette

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COURSE ATTRIBUTES: Check All That Apply

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2. Satisfactory/Unsatisfactory Only [ ]
3. Repeatable [ ] Maximum Repeatable Credit: [ ]
4. Credit by Examination [ ]
5. Designator Required [ ]
6. Special Fees [ ]
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Studio						
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Clinic						
Experiential						
Research						
Ind. Study						
Pract/Observ						

Cross-Listed Courses

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ME 44000 Automotive Prime Movers: Green Engines/Clean Fuels
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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		Date
Calumet Department Head: Bojan K Pa...	10/12/2011	Calumet School Dean	10/12/11
Fort Wayne Department Head		Fort Wayne School Dean	
Indianapolis Department Head		Indianapolis School Dean	
North Central Department Head		North Central Chancellor	
West Lafayette Department Head: James D. Jones	2/20/201	West Lafayette College/School Dean	7/25/11
		West Lafayette Registrar: Sandra Schaffer	10/30/11

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OFFICE OF THE REGISTRAR

ME 44000

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

Application of Thermodynamics, Fluid Mechanics and Heat Transfer to processes in Internal Combustion Engines. Intake and exhaust processes in engines. Spark-ignition, compression-ignition and alternate engines will be covered. Discussion of design and operating parameters and their influence on engine performance. Laboratory work on engine teardown, intake system, fuel injection system, spark-ignition and compression-ignition engines to complement lectures. Hybrid engines and fuel cell engines. Alternative fuels. Discussion of current challenges facing engine designers.

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

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 2/2/2011

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)

1. Hybrid engine components and their performance.
2. Hybrid system design and integration with vehicles.
3. Fundamental of PEM fuel cells
4. Performance parameters of 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

ME 44000

COURSE NUMBER:
ME 44000

COURSE TITLE:
Automotive Prime Movers: Green Engines and Clean Fuels

REQUIRED COURSE OR ELECTIVE COURSE:
Elective

TERMS OFFERED:
Spring

TEXTBOOK/REQUIRED MATERIAL:
Class notes

PRE-REQUISITIES:
ME 30000

COORDINATING FACULTY:
J. Abraham

COURSE DESCRIPTION:
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.

COURSE OUTCOMES [Related ME Program Outcomes in brackets]:

1. Relate processes in automotive engines to the *engineering fundamentals.* [A1,A2, A3, A4]
2. Study *low-carbon emitting* and LEV,ULEV,SULEV,PZEV, & ZEV engine 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]

ASSESSMENTS TOOLS:
Six homework assignments
Ten laboratory reports.
Project report and presentation
Mid-semester exam.
One comprehensive final exam.

RELATED ME PROGRAM OUTCOMES:

A1. Science & math
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

PROFESSIONAL COMPONENT:
Engineering Topics: Engineering Science – 2.50 credits (83%)
Engineering Design – 0.50 credits (17%)

NATURE OF DESIGN CONTENT:
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.

COMPUTER USAGE:
Computer usage is required for some laboratory problems.

COURSE STRUCTURE/SCHEDULE:
Lecture – 2 meetings per week at 50 minutes.
Lab – 1 meeting per week at 110 minutes

PREPARED BY:
J. Abraham

REVISION DATE:
May 14, 2010

ME 44000