This course is available for student registration only after the approval process has been completed.

**SUBJECT**: MAE
**COURSE NO.**: 4820
**CREDIT HOURS**: 3
**TERM TO BE ADDED TO THE FILE**: Fall 2014

*Justify level if 1000-level+ and no co- or prerequisites*

**CLASS HOURS** 45/semester
**LECTURE HOURS** 45/semester
**LAB HOURS**
**CONTACT HOURS (CEU ONLY)**

**DEPARTMENT**: Mechanical & Aerospace Engineering
**(e.g., Computer Science)**

**SCHEDULE TYPE**: Lecture (A)
**(e.g., Lecture, Lab or Special Topics/Project)**

☐ College of Aeronautics – 75
☐ College of Psychology and Liberal Arts – 75
☐ College of Science – 26
☐ College of Engineering – 1
☐ College of Business – 90

**COMPUTER TITLE**: Restricted to 25 characters, including spaces
**IC**: Engine Fundamentals
**Dual-Prefix, Bi-Level, Full-Load?** Yes ☐ No ☐

**CATALOG TITLE**: Internal Combustion Engine Fundamentals

**CATALOG DESCRIPTION OF COURSE**: Restricted to 350 characters, including spaces
Includes the thermodynamics of various power cycles, and emerging alternative fuels and power systems for automotive use (biofuels and their blends with gasoline and diesel fuel, direct injection, hybrid electric). Requires independent research project possibly leading to presentation at professional society meeting. (Requirement: Senior standing.)

This description has been approved by the catalog office.

EMJOY 10/21/13
Catalog Director

**In addition, please attach a course syllabus and/or more detailed description.**

**RESTRICTIONS**
☐ Prerequisite MAE 3191
☐ Co-requisite Course Number
☐ and or
☐ Prerequisite Course Number
☐ and or
☐ Prerequisite Course Number

**ADDITIONAL RESTRICTION**: As stated above: Senior standing

If this course replaces a course currently offered in BANNER, please indicate old course information and the date/term the course may be removed from the system.

**SUBJECT Alpha Prefix (e.g., MAE)**
**COURSE NO. (e.g., 1301)**
**TERM TO INACTIVATE**

☐ Yes ☐ No Will this course be used to measure program-level student learning outcomes? If yes, associate vice president for institutional compliance signature required.

**APPROVALS**: On completion of description and course number verification, affix appropriate signatures as indicated, and submit completed form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee for approval.

Organizer 10/22/13
Department Head/Program Chair 10/23/13
Dean/Associate Dean 10-28-13
Chair, Graduate Council 10-28-13
Chair, Undergraduate Curriculum Committee 10-28-13

**Associate Vice President for Institutional Compliance**

**CATALOG DIRECTOR**: These changes/additions have been made to the Florida Institute of Technology ∙ Office of the Registrar

**REGISTRAR’S USE ONLY**
SCACSE: 
SCADETL: 
SCAPREQ: 
SCABASE: 
SCARRES: 
Operator Init.: Date:

150 West University Boulevard, Melbourne, FL 32901-6975 ∙ (321) 674-8114 ∙ Fax (321) 674-7827
MAE 4820: Internal Combustion Engine Fundamentals
Fall 2014

2014-2015 Catalog Data: MAE 4820 Internal Combustion Engine Fundamentals. Credits 3. Topics include detailed thermodynamics of various power cycles, emerging alternative fuels and power systems for automotive use (biofuels, biofuel/gasoline blends, biofuel/diesel fuel blends, direct injection, hybrid electric, fuel cells). Students will work on projects leading to presentations/technical papers at professional society meetings. (Prerequisite: MAE 3191) and Senior Standing.

Required/Elective: Elective

Prerequisites by Topic: Thermodynamics 1
Co-requisites by Topic: None

Textbook (T):

Course Outcomes: The student will be able to:
1. Demonstrate the ability to perform engine performance calculations.
2. Demonstrate the ability to work in groups to mathematically model various engines, including the effects of intake and exhaust conditions in order to design a new system.
3. Demonstrate the ability to work in groups designing and conducting laboratory experiments.
4. Demonstrate an understanding of the emissions formation and control processes including the effect of changing operating conditions.
5. Demonstrate an understanding of alternative fuels and power systems and their effects on the environment.
6. Make engineering design decisions on power plant type, internal combustion, hybrid electric, etc.
7. Gain exposure to professional organizations presentations and report writing.
8. Demonstrate the ability to work on a topic which is relevant to industry.

Topics Covered:
1. Engine terminology, classifications (2 hours)
2. Engine operating characteristics, working equations (2 hours)
3. Spark ignition (SI) engine cycle analysis (3 hours)
4. Ideal intake and exhaust analysis. (2 hours)
5. SI Engine at part throttle, pumping losses (2 hours)
6. Compression Ignition (CI) engine cycle (3 hours)
7. Dual Cycle, modified cycles (3 hours)
8. Computer models to predict engine performance, engine design. (4 hours)
9. Combustion (4 hours)
10. Hydrocarbon fuels. (1 hours)
11. Introduction to alternative fuels. (1 hour)
12. Intake manifold design and volumetric efficiency (3 hours)
13. Fuel injection systems (3 hours)
14. Turbocharging, supercharging (3 hours)
15. Computer modeling of complex in-cylinder flow fields. (3 hours)
16. Work on current contemporary projects, student presentations (3 hours)
17. Examinations (3 hours)

Total Class hours: 45
Grading:
Homework: 20%
Midterm 1: 25%
Midterm 2: 25%
Final Exam: 30%

Class Schedule: 3.0 hours/week
Relationship to Course Outcomes and Student Outcomes: See assessment matrix and course notebook.

Assessment Process: Examinations, graded homework, term projects.

Prepared by: Gerald J. Micklow, PhD, PE, Professor of Mechanical Engineering

### Outcomes Assessment Matrix for MAE 4820

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>A</th>
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<th>C</th>
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#### Key

**A** An ability to apply knowledge of mathematics, science, and engineering

**B** An ability to design and conduct experiments, as well as analyze and interpret data

**C** An ability to design a system, component, or process to meet a desired need

**D** An ability to function on multi-disciplinary teams

**E** An ability to identify, formulate, and solve engineering problems

**F** An understanding of professional and ethical responsibility

**G** An ability to communicate effectively

**H** Have a broad education necessary to understand the impact of engineering solutions in a global and societal context

**I** Recognition of the need for, and an ability to engage in, life-long learning

**J** Knowledge of contemporary issues

**K** An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

**L** An ability to work professionally in the thermal systems area including the design and realization of such systems

**M** An ability to work professionally in the mechanical systems area including the design and realization of such systems

◇ = The course outcome lightly addresses the Student Outcome

◆ = The course outcome strongly addresses the Student Outcome

Course assessment completed by: Date:

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MAE 4820 Course Syllabus

Fall 2014