**COURSE NUMBER & COURSE TITLE:** ME XXX Advanced powertrain technology outlook

**INSTRUCTOR:** Min Xu  
**Credits:** 2  
**Language of instruction:** English

**REQUIRED COURSE OR ELECTIVE COURSE:** Elective  
**TERMS OFFERED:** Spring semester

**COURSE STRUCTURE/SCHEDULE:**
- Lecture: 1 day per week at 3 hour
- Lab

**PRE-REQUISITES:**
- Internal combustion engine fundamentals
- Introduction to automotive engineering

**ASSESSMENT TOOLS:**
- Class attendance: 10%
- Pre-class quiz: 10%
- Team presentation: 25%
- Experiment: 15%
- Final paper: 40%

**PROFESSIONAL COMPONENT:**
1. Mechanical engineering
2. Automotive engineering

**TEXTBOOK/READING LIST**
1. DRI-WEFA Inc., Future Powertrain Technology Report
2. AT-Kearning Inc. Internal Automotive Powertrain Technologies Outlook
3. General Motors Company, Automotive Powertrain Strategies Report

**COURSE DESCRIPTION:**
The advanced powertrain technology outlook class discusses the main technologies and their future trends concerning the automotive powertrain technologies. Based on his more than 20 years' oversea experience, Prof. Min Xu will give extensive and comprehensive talks about the main technologies involved in the research and development of automotive powertrains. The topics will cover internal combustion engine, hybrid, transmission, alternative fuel, fuel cell, emission and after treatment. Graduate students who take this course can obtain a compressive understanding for those advanced technologies, laying a solid foundation for their future research or career. This class is all in English with extensive group discussions. Though this class, it is expected that the students can improve their skills in self-learning, criticizing, innovation, communication and international perspective.

**COURSE OUTCOMES** [Related ME Program Outcomes in brackets]
This course focuses on the advanced technologies in automotive powertrain development. Both the traditional and newly emerging technologies will be covered. By combining the lectures and experiments in practical powertrain development, the students can have chances to extend their knowledge and perspective. The objectives of this course are:
1. Have a compressive understanding of the history, present and future trends of automobile powertrains [A3, A5.1];
2. Understand the advanced automotive powertrain technologies from both macroscopic and microscopic scales[A3, A5.1];
3. Criticizing: gain insight by comparison between different technologies [B3, B7];
4. Collaborative and teamwork skills [B1, B2, B4.2, B8, C4]
5. Extend the knowledge by knowing the latest technology development [A5.1, B4.2]
6. Summarizing and presentation skills [B1, B3, B8]
7. English communication and writing skills [B4.2, B6]

**RELATED ME PROGRAM OUTCOMES:**
- A1. Engineering Fundamentals  
- B1. Communication Skills  
- B3. Contemporary Issues  
- A2. Analytical Skills  
- B2. Teamwork Skills  
- C1. Leadership

**PREPARED BY:** Min Xu  
**REVISION DATE:** Jan. 9, 2013
ME XXX Advanced powertrain technology outlook

Course Syllabus

COURSE INSTRUCTORS

| Name: Min Xu | Name: |
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| Email: mxu@sjtu.edu.cn | Email: |

COURSE DESCRIPTION

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TEXTBOOK

1. AT-Kearning Inc. Internal Automotive Powertrain Technologies Outlook

READING REFERENCE

1. General Motors Company, Automotive Powertrain Strategies Report
2. DRI-WEFA Inc., Future Powertrain Technology Report

COURSE PRE-REQUISITES

Internal combustion engine fundamentals
Introduction to automotive engineering

COURSE LEARNING OBJECTIVES

This course focuses on the advanced technologies in automotive powertrain development. Both the traditional and newly emerging technologies will be covered. By combining the lectures and experiments in practical powertrain development, the students can have chances to extend their knowledge and perspective. The objectives of this class are:
1. Have a compressive understanding of the history, present and future trends of autotomize powertrains [A1];
2. Understand the advanced automotive powertrain technologies from both macroscopic and microscopic scales [A1, A2];
3. Criticizing: gain insight by comparison between different technologies [A2];
4. Collaborative and teamwork skills [B1, B2]
5. Extend the knowledge by knowing the latest technology development [B3]
6. Summarizing and presentation skills [B1, B2, C1]
7. English communication and writing skills [B1]

GRADING FORMAT AND POLICY

1. Class attendance-10%
2. Pre-class quiz-10%
3. Team presentation-25%
4. Experiment-15%
5. Final paper-40%

Grading rules

1. The class attendance will base on the attendance, the discussion and the Q&A session.
2. The pre-class quiz has 5 single chosen questions and the scores will be normalized at the end of the semester.
3. The speaker of the team presentation will have a 10%-25% plus scores, depending on the quality of the presentation
4. The final paper is a free-chosen subject. The paper should base on a scenario (real or speculate). The students should analyze the scenario and draw clear conclusions.

DESIGN PROJECTIONS

Engine benchmark work in Institute of Automotive Engineering: students will disassemble an automotive engine taken from a modern car. The students should identify the engine parts and connect them with the topics discussed on the class.

TEAM-WORK

Divide the students to 7 research groups. Each groups need to cover one topic of the following:

1. Advanced Combustion Engine Technology Outlook(I)
2. Advanced Combustion Engine Technology Outlook(II)
3. Emission regulation and after treatment technologies
4. Advanced alternative fuels technology
5. Advanced transmission technology
6. Advanced hybrid technology
7. Advanced fuel cell technology

Each group needs to prepare a PPT file before the class that covers the specific topic and present on the class. The presentation time should be no less than 45 min. After the presentation, the students can have discussions and questions. The speaker should respond to those questions. The instructor will have some comments on the presentation and discussions.

**COURSE ROAD-MAP AND SCHEDULE**

<table>
<thead>
<tr>
<th>Week#</th>
<th>Lecture#</th>
<th>Lecture Topic</th>
<th>Lecturer</th>
<th>Reference</th>
<th>Homework</th>
<th>Lab/Recitation Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>Introduction</td>
<td>Min Xu</td>
<td>GM strategic report; DRI-WEFA Inc. FPT report</td>
<td>Group1: presentation on advanced internal combustion engine (I)</td>
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<td>2</td>
<td>4</td>
<td>Advanced Combustion Engine Technology Outlook(I)</td>
<td>Min Xu</td>
<td>GM strategic report; DRI-WEFA Inc. FPT report</td>
<td>Group2: presentation on advanced internal combustion engine (II)</td>
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<td>3</td>
<td>4</td>
<td>Advanced Combustion Engine Technology Outlook(II)</td>
<td>Min Xu</td>
<td>GM strategic report; DRI-WEFA Inc. FPT report</td>
<td>Group3: presentation on emission regulation and after treatment</td>
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<td>4</td>
<td>4</td>
<td>Emission regulation and after treatment technologies</td>
<td>Min Xu</td>
<td>GM strategic report; DRI-WEFA Inc. FPT report</td>
<td>Group4: presentation on advanced alternative fuels</td>
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<td>5</td>
<td>4</td>
<td>Experiment</td>
<td>Min Xu</td>
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<td>Lab tour and engine benchmark</td>
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<tr>
<td>6</td>
<td>4</td>
<td>Advanced Alternative Fuels Technology</td>
<td>Min Xu</td>
<td>GM strategic report; DRI-WEFA Inc. FPT report</td>
<td>Group5: presentation on advanced transmission technology</td>
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<td>7</td>
<td>4</td>
<td>Advanced transmission technology</td>
<td>Min Xu</td>
<td>GM strategic report; DRI-WEFA Inc. FPT report</td>
<td>Group6: presentation on advanced hybrid technology</td>
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<td>8</td>
<td>4</td>
<td>Advanced hybrid technology</td>
<td>Min Xu</td>
<td>GM strategic report; DRI-WEFA Inc. FPT report</td>
<td>Group7: presentation on advanced fuel cell technology</td>
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<td>9</td>
<td>4</td>
<td>Advanced fuel cell technology</td>
<td>Min Xu</td>
<td>GM strategic report; DRI-WEFA Inc. FPT report</td>
<td>Final paper</td>
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