Course Outline and Grading Policy

Course: ME 468 Engine Design

Semester: Spring 2010

Catalog Data: Application of the knowledge of the mechanics, thermodynamics and fluid mechanics to the design of internal combustion engines to meet specific mission requirements. Optimization of the design using computer modeling and parametric studies.

Objectives: Develop in students a working knowledge of system design as related to the automobile and its power plant. Understand the factors which influence internal combustion engine performance and apply this knowledge to analyze and propose new solutions for improvements in efficiency and/or overall packaging. Develop an understanding of heat release and heat rejection and use this knowledge to predict overall vehicle efficiency and performance. Expose the students to laboratory testing of combustion engines and develop a knowledge of techniques that might be used to evaluate improvements to design changes. Through design exercises develop an appreciation for the necessity of understanding design objectives and the iterative nature of the design process while advancing their knowledge in heat engine and total vehicle design.

Class Hour: Mondays 3:30 to 4:20 PM.
Wednesdays 3:30 to 4:20 PM.

Lab Hour: Tuesdays 9:30 to 12:20 PM
Thursdays 9:30 to 12:20 PM

Class Room: Rm C123 Parkview Campus
Lab Room: Rm F210 Parkview Campus

Text: "Internal combustion engines" by C. R. Ferguson (John Wiley & Sons, Inc.)
Reference: "Introduction to Internal Combustion Engines" by R. Stone (SAE Publication)
"The Internal Combustion Engine in Theory and Practice" by C. F. Taylor (MIT Press)
"Internal Combustion Engine Fundamentals" by J. B. Heywood (McGraw Hill Inc.)

Prerequisite: ME 358, ME 367 or ME 432

Instructor: Dr. Bade Shrestha, Associate Professor, P.Eng.
Dept. of Mechanical and Aeronautical Engineering
Western Michigan University
Phone: 269 – 276 3432
Fax: 269 - 276 4321
Email: Bade.Shrestha@wmich.edu

Office: Room G 218, Parkview Campus
Office Hours: Mon & Wed: 2 – 3:30 P.M.

Topics to be covered

1. Power Plant Matching/Requirements
2. Alternative Power Plants/their Prospectus
3. Power Plant Optimization
4. Efficiency and Losses
5. Engine Modeling
7. Combustion Chamber Design

**Laboratory Activities:**

The laboratory portion of the course will have two separate components focused on providing a broad background in prime mover design. The components of the course will include:

I. Experimental Investigations:
   These activities will be centered around providing experience in engine mapping, heat release and/or design verification. A formal written report, submitted by each group, will be required at the closure of each experiment.

II. Design Projects:
   Design projects will focus on meeting system and design goal specifications, which may include power plant matching, and the design of major systems within the power plant or power plant system. The vehicle and its performance objectives, as determined by the design team, will be used as the basis for all design decisions throughout the term.

The Design projects will include:

- Proposal with Team defined Due February 3

- Report I: Vehicle requirements Due February 24
  *(For a typical project)*
  - Mission requirements
  - Vehicle baseline steady-state power requirements
  - Vehicle transient power requirements

- Report II: Power plant and Energy consumption Due March 24
  *(For a typical project)*
  - Power plant selection and sizing
  - Vehicle energy and thermal loads
  - Preliminary performance

- Report III: Induction/Exhaust Design Due April 5
  *(For a typical project)*
  - Engine power producing component design

- Final Report: Technology innovations in your design Due April 15
  - Final Engine performance
  - Engine systems

The design projects will require a formal written report submitted at the end of each project, on or before the due date. Each separate project may contain more than one specified activity to bring the project to a logical conclusion.

One final report compiling all previous design activities will be submitted as a summary of the design reflecting any design changes which were necessary during the course of the individual activities and should contain all pertinent and related information. The final report of the final design project must address the following questions:

1. What was done?
2. The design approach used.
3. The design methodology employed.
5. What were the results? Are they reasonable? Are they feasible?
6. Recommendations for a better approach to the design process.

A List of potential design projects accompanies this syllabus. Projects outside of this list are encouraged especially if they have industry support. All projects will be approved by the instructor by February 3, 2010.

**GRADING:** The final grade will be based on the following criteria:

- Homework and Computer Assignments ................................................................. 10%
- Laboratory
  - Experimental Work w/report ........................................................................... 10%
- Design Projects
  - Design Project reports (including progress reports)
    - Report 1 ........................................................................................................ 5%
    - Vehicle baseline energy requirements (*For a typical project*) .....................
    - Report 2 ........................................................................................................ 10%
    - Power plant selection, sizing and energy loads (*For a typical project*) .......
    - Report 3 ........................................................................................................ 10%
    - Component Design (*For a typical project*) ...................................................
  - Final Project Report .......................................................................................... 10%
  - Final Oral Presentation (*Tentative date: April 13 and 15*) ............................ 10%
- Examinations
  - Mid-Term {February 24, 2010, Wednesday} ................................................ 15%
  - Final {According to the final exam schedule: April 27, Tuesday, 2010, 12:30 – 2:30 PM} ........ 20%

The final examination will be a written exam and may cover any aspect of the class including lecture materials, experimental investigations and design projects.

**Grading Scale**

- A: Above 90.0 %
- B+: 85.0 -89.9 %
- B: 80.0 - 84.9 %
- C+: 75.0 - 79.9 %
- C: 70.0 - 74.9 %
- D+: 65.0 - 69.9 %
- D: 60.0 - 64.9 %
- E: Below 60.0 %

**Important Notice:** “You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at http://catalog.wmich.edu under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.”