SYLLABUS
MAE 472 – Engineering Systems Design
Formula SAE®

Term: Spring Semester 2017
Section: 003
CRN: 13661
Time: MW 3:00pm – 5:50pm
Class Room: MRB-E 209
Laboratory: ESB-E G15
Instructor: Scott Wayne, Ph.D., Associate Professor
           Room 747 ESB
           Phone: (304) 293-3246
           Cell: (304)-288-9544
           Scott.Wayne@mail.wvu.edu
           Office hours: M W F 11:00 AM -12:00 PM
Text: None
Pre-requisites: MAE 471.
Course Description: MAE 472 is a 3-credit hour, technical elective. It is taken in the senior year, preferably in the penultimate semester. The course involves identification and solution of challenging engineering problems through rational analysis and creative synthesis, planning, designing and reporting on complex systems on individual and group basis.
This section of MAE 472 is associated with the Formula SAE Collegiate Competition Series sponsored by SAE International which challenges students to conceive, design, fabricate and compete with small Formula-style autocross race cars. The target marketing group for the race car is the non-professional weekend autocross racer. In order to appeal to this market, the car must have very high performance in terms of acceleration, braking and handling and it must be reliable, easy to maintain and low in cost. Marketability should also be enhanced by aesthetics, comfort and use of commonly available parts. The project culminates in a final competition where students will showcase their creativity, engineering and design skills and evaluate their race car against entries from 120 pier universities from around the world.
In MAE 472 students will work from the engineering design that was competed in MAE 471 during the fall semester and will fabricate, assemble, test, tune their prototype racecar in preparation for the Formula SAE Competition held May 11-14 at Michigan International Speedway. The students will also complete a detailed manufacturing cost analysis, written design report and a design presentation and marketing presentation for the competition.
Course Goal: The goal of this course is to expose students to the process of real-world, open-ended engineering design giving them the opportunity to apply the knowledge and skills they have learned through their undergraduate education to conceive, design, fabricate, test and market a complex system, machine, device or product that meets identified functional and performance requirements.
Educational Objectives: The specific educational objectives are:
• To teach students how to apply the principals of engineering design to open-
ended, real-world, iterative design of a complex device, system or process.

- To develop techniques and skills necessary to work with a multidisciplinary team of professionals from diverse backgrounds to design, manufacture, and market a product that meets specified requirements.
- To reinforce the technical writing and oral communication skills necessary to succeed in an engineering career.
- To expose students to issues important to a career in engineering.

**Learning Outcomes:** The course addresses four primary pedagogical learning outcomes:

- Graduates will demonstrate the ability to design a system, component or process to meet specified needs. Specifically, the student will be able to synthesize knowledge from their undergraduate education to design a complex machine, device or system that will meet specific functional and performance criteria, such as size, strength, durability, accuracy, efficiency, customer expectations, cost or other pertinent measures as determined by the project.

- Graduates will demonstrate the ability function as part of a multidisciplinary team. Students will be able to work as part of a team comprised of engineering professionals from multiple engineering disciplines and specialties as well as non-engineering disciplines such as business, marketing, and public relations to develop, demonstrate and market a product that meets the needs of a target market. Specifically, students will have the ability the use of tools and techniques to manage project timelines, track progress against milestones, distribute tasks among team members, and manage personnel assignments and resources.

- Students will demonstrate competence in professional communication, including both written and oral communication. Specifically, students will be able to develop well written, grammatically correct technical and non-technical written documents that are appropriate for their target audience including, technical proposals, technical reports, literature reviews, progress reports, conference/journal papers, etc. Students will be able to prepare and deliver quality oral presentations to various audiences. Finally, students will understand the importance of ethics in technical writing, properly citing the work of others, and avoiding plagiarism.

- Students will be cognizant of issues important to their careers, including professional ethics, international standards, professional registration and lifelong learning.

**ABET Outcomes:** MAE 472 is a technical elective and therefore is not a key course for any of the key ABET Outcomes. However it supports the following ABET Outcomes:

A  An ability to apply knowledge of mathematics, science and engineering
B  An ability to design and conduct experiments, as well as to analyze and interpret data
C  An ability to design a system, component or process to meet desired needs
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  The broad education necessary to understand the impact of engineering solutions in a global and societal context
I  A recognition of the need for, and an ability to engage in life-long learning
SAE Competition: It is expected that students enrolled in MAE 472 will participate in the Formula SAE Competition May 9-14, 2017 in Brooklyn Michigan. It is vitally important to the MAE Department, the Statler College and the University (which provided extensive funding for the project) that the Formula SAE team attends the competition, performs well in the events and represents WVU well. This requires students who are committed to completing the racecar on time, producing high quality reports and cost analysis and representing WVU at the competition. All students who attend the Competition are required to be members of SAE International. Student membership costs approximately $25. You can register online at www.sae.org.

Grading: Your grade in this course will be primarily determined based on the amount of effort that you devote to the project. Effort will be assessed by several mechanisms:

1. **Shop Log** – Every student must keep a detailed record of the time that you spend working on the project. Each entry in your shop log must include the date, time you started working, time you stopped working, number of hours you worked and a brief summary of what you worked on.

2. **Pier Evaluations** – You will be graded by your fellow students through pier evaluation forms at roughly mid-semester and at the end of the semester.

3. **Instructor’s Evaluation** – I will also evaluate your effort and contribution to the project. Throughout the semester I will work closely with students on machining and fabrication and I frequently stop in the shop to check on progress. By the end of the semester I have a generally know which students devoted significant effort to the project. My assessment is based on my knowledge of what you worked on throughout the semester.

4. **Self-Evaluation** – At the end of the semester I will ask you to submit a short summary of your activities and contributions to the project listing the parts you fabricated or worked on, what role you played in completing the require reports and cost analysis, etc.

The remaining portion of your grade will be based on the quality of the written reports, cost analysis, design binder and other deliverables that the team submits to the competition. This component of the grade will be a team grade meaning that every student of the team or sub-team gets the same grade.

This project will require a motivated, energetic effort to be successfully completed. You must attend team meetings to be an active member of the team. Those who are absent more than 25% of the time will get a failing grade for the course. Your grade will be lowered if you do not attend and participate. This course requires a minimum of 12 hours effort per week.

Your grade will be composed of several parts. The areas that will be considered and approximate grade distribution are as follows:

- 85% - Class attendance participation and individual effort
  - 15% Shop Log
  - 40% Pier Evaluation
  - 30% Instructor Evaluation
- 15% Quality and Completeness of Competition Deliverables
**Classroom Conduct:** Since you are all professionals in training, you are expected to conduct yourself in a professional manner while in this class. For instance, while the class is in progress, everyone is expected to remove their hats and sunglasses, put away the newspaper, refrain from eating and drinking, and turn off cell phones. When giving a presentation, you are expected to dress professionally. As part of your professional preparation, you should begin acquiring professional attire (dress shoes, slacks, shirts, and ties). Please do not force the instructor to remind you that you should behave in a professional manner.

This code of conduct also applies to any out of class experiences you choose to attend. Dress and behave professionally at the competition, during tours and at publicity events.

**Safety Training:** All MAE classes that use a laboratory or mechanic shop space are required to have federally mandated laboratory safety and hazardous materials training. The laboratory safety and hazardous materials training must be renewed on annual basis. Students with training that will expire before the end of the semester must renew their training by January 30, 2017. The safety training is provided by WVU Environment, Health and Safety department. The training can be accessed through eCampus by following information for the online version located at http://ehs.wvu.edu/training/lab-safetyhazardous-materials. Students are required to review and understand the safety PowerPoint presentation and complete three main module tests by January 30, 2017. There is an unlimited number of chances to get 80%. MAE policy states that the failure to take the online safety quiz or failure to obtain 80% on the quiz, will result in receiving a failing grade for the course. Any questions or issues (technical and content) with regards to the safety training material or quiz should be directed to Kathy Sabolsky kathy.sabolsky@mail.wvu.edu.

**Shop Participation:** We will be observing new safety regulations and training this semester. You will be required to get training and be familiar with operations in the shop. Any work in the shop must be approved and supervised by the technician or instructor. Do not use any tool or machine unless the technician or instructor has provided you the proper training on safe and proper use of the machine. Report any damage of equipment or tooling to the instructor so that proper repairs can be made to ensure the equipment is returned to a safe operating condition.

Observe all safety rules and proper procedures while in the shop. **Eye protection must be worn while working in the shop.** Do not wear rings, necklaces or jewelry when using or near machinery. Make sure that long hair and loose clothing are not exposed to moving machinery.

**OPEN-TOE SHOES AND SANDALS ARE PROHIBITED IN THE SHOP AT ALL TIMES. Do not wear open-toed shoes or sandals on class day or if you plan to be in the shop at any time that day.**

Before using any solvents, paint, or chemicals make sure you have proper ventilation and breathing protection and are aware of the hazards that go along with the material being used. Material Safety Data Sheets are provide for all chemicals used or stored in the shop. If you are not sure of the potential hazards, **ASK SOMEONE IN CHARGE OF THE SHOP**.

**I AM NOT YOUR MOTHER! I AM NOT YOUR MAID! I AM NOT THE JANITOR.** The shop must be kept clean and neat at all times. Put tools away when you are finished using
them. Clean up millings, shaving and filings from the mill, lathe and other equipment when you finish using them. Clean off excess cutting fluids. The shop serves multiple projects be respectful to other students by cleaning up your work area before you leave for class or to go home.

**USE OF THE SHOP FACILITY, VEHICLE HOIST, TOOLS OR EQUIPMENT TO PERFORM MAINTENANCE ON YOUR PERSONAL VEHICLE IS STRICTLY PROHIBITED.** Any student found working on a non-university owned vehicle in the shop will be referred to the Department Chairman or Dean for disciplinary action which could include dismissal from the course or a failing grade.

**Test Driving:**
Cars cannot be driven without permission. Full safety equipment must be worn when driving. This includes the seat harness, wrist restraints, helmet, neck support, driving suit and goggles. A fully charged fire extinguisher must also be in the car when it is driven. Formula cars may not be driven on public roads or in the parking lots around the Engineering building. Cars may be driven only in the designated test area. The WVU DPS officers will be looking for us to be on the road, so watch your step.

**Attendance Policy:**
Class attendance is mandatory unless excused by the instructor. The basis for an excused absence will follow University policy. Students who are absent from class for any reason are responsible for all missed work. Students who miss a quiz or an exam will not be permitted to make it up, except in the case of a documented family or other legitimate emergency. Any exception will be allowed at the sole discretion of the instructor.

**Special Concern Days:**
WVU recognizes the diversity of its students and the needs of those who wish to be absent from class to participate in Days of Special Concern, which are listed in the Schedule of Courses. Students should notify their instructors by the end of the second week of classes or prior to the first Day of Special Concern, whichever is earlier, regarding Day of Special Concern observances that will affect their attendance. Further, students must abide by the attendance policy of their instructors as stated on their syllabi. Faculty will make reasonable accommodation for tests or field trips that a student misses as a result of observing a Day of Special Concern.

**Academic Integrity:**
The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code at [http://campuslife.wvu.edu/office_of_student_conduct](http://campuslife.wvu.edu/office_of_student_conduct). Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.

**Policy of Zero Tolerance in Academic Dishonesty.** It is an MAE Departmental Policy, that cheating of any kind or form in exams, quizzes, project or assignments will result in formal disciplinary action that may include unforgivable F (UF), suspension or dismissal from the Program.
Inclusivity Statement: The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Accessibility Services (293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see http://diversity.wvu.edu.

Important Dates:

January 9, 2017  First Day of Classes
January 13, 2017  Last day to add/drop courses
January 16, 2017  Martin Luther King Day (recess)
January 16, 2017  Business Logic Plan Due at 11:59 PM EST
January 16, 2017  Structural Equivalency Spreadsheet Due at 11:59 PM EST
January 16, 2017  Structural Requirements Compliance Form Due at 11:59 PM EST
January 30, 2017  Electronic Throttle Control Failure Modes and Effects Analysis Due at 11:59 PM
February 20, 2017  Impact Attenuator Test Data Due at 11:59 PM EST
February 24, 2017  Mid Semester
February 27, 2017  Program Submissions Due
March 3, 2017  Midterm Reports Due
March 6, 2017  Design Report and Spec Sheet Duel at 11:59 PM EST
March 4-12  Spring Recess
March 24, 2017  Last day to drop a class
April 3, 2017  Hardcopy Cost Reports Due
April 3, 2017  Electronic Cost Report and eBOM Due
April 3, 2017  Fuel Type Order Due
April 27, 2017  Last Day to withdraw from the University
April 28, 2017  Last day of class (Friday)
May 1-5, 2017  Final Examination Week
May 9-14, 2017  FSAE Michigan Competition