

ENGINEERING H193 SYLLABUS - SPRING QUARTER 2009

Engineering Fundamentals and Laboratory III

Engineering Fundamentals - Purpose. This portion of the course will focus primarily on planning, management, documentation, and presentation of the Fundamentals of Engineering for Honors (FEH) robot design project. Students will learn how to plan and manage a project, present analyses of their results, write a project report, and make an oral presentation on the work.

Engineering Laboratory - Purpose. This portion of the course will focus on analyzing, modeling, building, and testing the device required for the FEH design project. The main objective for each team is to build a self-controlled, self-contained, and self-propelled robotic vehicle that will travel over a well-defined course. Along the way, each robot will have to start when the light in the start area turns on, navigate through the course, and complete the required tasks. Teams will be scored based on their design and how well it performs in both individual and head-to-head competition runs.

During the hours allocated for this course, there will be some lectures on the technical approach to design, mathematical calculations required, and various laboratory tools and techniques that are helpful in completing the design. A portion of class time will be for open lab where teams may work on their projects with instructors and teaching assistants available to answer questions. Before purchasing chassis, drive train, and pickup mechanism parts your team must model the assembly in Inventor or other CAD package.

Class Meeting Times and Course Credit. Your ENG H193 section will meet at one of the following times: 7:30–9:18, 8:30–10:18, 9:30–11:18, 10:30–12:18, 11:30–1:18, 12:30–2:18, or 1:30–3:18 on Mondays, Wednesday, and Fridays. All class sessions are held in HI 206, HI 214, or HI 216. Open lab time will be available in HI 208 and other rooms as announced. Course credit is 4 hours.

Integration of FEH Courses. The design project for this course is a small, autonomous robot. The design and construction of the device will require the use of at least parts of all of your previous FEH program courses. A separate document will provide the complete design project guidelines and competition rules.

ENG H193 Course Materials Fee. There is a \$75 course materials fee charged for consumable materials for this course. This fee was automatically added to the student fee statement for Spring Quarter.

ENG H193 Loaned Tools and Materials Policy. Please note that all tools, equipment, and materials assigned to a team must be returned and formally accounted for at the end of each session. Failure to return any OSU item will result in a grade of incomplete for the entire team until the item is found or otherwise accounted for, and the situation will taken to the Committee on Academic Misconduct.

Required ENG H193 Textbooks. Note that all required textbooks have either been previously purchased by the student or will be supplied (loaned to the project team) at no additional cost.

Tools and Tactics of Design, (TTD) Dominick et al., Wiley, 2001.*

A Guide to Writing as an Engineer 2nd Ed., (WE) Beer and McMurrey, Wiley, 2005.*

Technical Graphics, Meyers et al., Schroff Development Corporation, 2007.*

An Introduction to Inventor 2008 and AutoCAD 2008, Shih, Schroff Development Corp, 2007*

Robotic Explorations: A Hands-on Introduction to Engineering (Martin), Fred Martin, Prentice-Hall, 2001.†

* Already purchased by student previously † Supplied as part of project kit

Within the Daily Schedule provided below, textbook abbreviations shown in parenthesis above are used to identify in which text the assigned readings are given. For example, “TTD” refers to the *Tools and Tactics of Design* textbook.

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H193 Instructional Staff:

INSTRUCTORS	OFFICE	PHONE	EMAIL
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ENGINEERING H193 DAILY SCHEDULE – SPRING QUARTER 2009

Over Spring Break

- READ: *Tools and Tactics of Design* by Peter Dominick, et al.

WEEK 1

Monday, March 30

- Lecture W01 D01 – Introduction to course; Where the course fits into undergraduate programs; Required materials; Course fees
- Design team assignment, organization; discussion of teamwork; teamwork agreements; brainstorming
- READ: Chap. 3 TTD, Team Agreement, and scan Chap. 1, 2, and 4 TTD

Wednesday, April 1

- Lecture W01 D02 – Documentation lecture topic: notebooks, strategy discussion, sketches for brainstorming ideas
- Teams work on brainstorming lists, brainstorming sketches, and design strategy
- Distribution of the Robot Starter Kits
- Pre-Lab Assignment: Input ports, microswitch, CdS cell, optosensor, motor ports (Sensor Lab):
READ: Chap. 1 (Sec 1.1, 1.2) & 3 from Martin; Lab 1 Write-Up on FEH web site

Due: Signed teamwork agreements

Friday, April 3

- Lecture W01 D03L – Lab lecture topic: Preparation For Lab 1 – Sensors: microswitches, CdS cells, optosensors, motors
- Lab 1 – Sensors
- Pre-Lab Assignment: Break-Beam Sensors (shaft encoders), Motors, Gears, and Mechanisms (Motor Lab): READ: Chap. 3 (Sec 3.7 & 3.8) & 4 from Martin; Lab 2 Write-Up on FEH web site
- READ: Chap. 2 TTD, Design Schedule; Chap. 5 WE, Laboratory Reports

WEEK 2

Monday, April 6 (7:30, 9:30, 11:30, 1:30) or Wednesday, April 8 (8:30, 10:30, 12:30, 2:30)

- Lecture W02 D01L – Lab lecture topic: Preparation for motor performance lab, shaft encoders, motor tests
- Lab 2 - Motor Performance Lab: Motor current required, no load speed, maximum torque

Due: Brainstorming list, sketches, and strategy for robot in competition

Wednesday, April 8 (7:30, 9:30, 11:30, 1:30) or Monday, April 6 (8:30, 10:30, 12:30, 2:30)

- Lecture W02 D02 – Documentation lecture topic: project design schedule
- Lecture W02 D02A – Lecture: Power train analysis
- Work on Lab 1 – Sensors Reports

Friday, April 10

- Lectures W02 D03 - Lecture topic: Team Review
- Lectures W02 D03A - Technical lecture topic: Building a Mockup for your design
- Work on robot mockup, Drive mockup around the course
- Refine design schedule
- Teams meet with faculty to discuss progress

Due: Lab 1- Sensors Report

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WEEK 3

Monday, April 13

- Lecture W03 D01 – Lecture topic: Design Project Shop Safety Considerations
- Design Project Shop Tour and Orientation
- Pre-Lab Assignment: Servo Motors (Servo Motors and IR Receivers): READ: Chap. 4 (Sect. 4.4) from Martin; Lab 3 Write-Up on FEH web site

Due: Design Schedule

Wednesday, April 15

- Lecture W03 D02 – Review of Guidelines for Performance Test 1.
- Lecture W03 D02L – Lab lecture topic: Preparation For Lab 3 – IR Beacons / Receivers & Servos
- Lab 3 – IR Beacons / Receivers & Servos

Due: Lab 2 - Motor Performance Report

Friday, April 17

- Lecture W03 D03 – The Schedule Ahead
- READ: Chap. 4 (Sect. 4.1) from Martin and Chap. 5 WE, Progress Reports
- Work on robots
- Teams meet with faculty to discuss progress

Due: Sketches of chassis, chassis requirements (e.g. weight, size, height, space for mounting systems, important features, etc.)

Deadline: Performance Test 1 – Teams must have either: 1) a portion of chassis built (basic structure with wheels in place); or 2) a completed mockup (basic structure with simulated wheels) and some progress on chassis.

WEEK 4

Monday, April 20

- Lecture W04 D01 – Documentation lecture topic: Progress Reports
- READ: Chap. 5 & 6 WE – Writing common engineering documents, Writing a project report
- Work on robots

Due: Calculations and sketches for power train - including transmission/ gear train requirements

Wednesday, April 22

- Lecture W04 D02 – Documentation lecture topic: Final report, Review of guidelines for Performance Test 2
- Lecture W04 D02A – Software lecture topic: Tips and hints for successful robot code
- Lecture W04 D02B – Software lecture topic: “Mission Critical” (Alcatel-Lucent Presentation)

Due: Lab 3 - IR & Servos Report

Friday, April 24

- Lecture W04 D03 – Team Peer Evaluation, The Schedule Ahead
- Work on robots
- Teams meet with faculty to discuss progress

Due: Progress Report, Early chassis solid model in Inventor (or other CAD package).

Deadline: Performance Test 2 – Solid Model of Chassis and Drive Train required. Teams must have motor installed and able to propel robot chassis up ramp.

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WEEK 5

Monday, April 27

- Lecture W05 D01 – Guidelines for flowchart and pseudo code
- Work on robots

Due: Outline of final report

Due: Team Peer Evaluation #1 Due (Not for grade)

Wednesday, April 29

- Lecture W05 D02 – Review of Performance Test 3 requirements
- Lecture W05 D02A – Software Lecture Topic: Line Following Algorithms
- Work on line following
- Work on robots

Friday, May 1

- Lecture W05 D03 – A look ahead to Week 6, Reminder of Final Report Draft due on Monday
- Work on robots
- Teams meet with faculty to discuss progress
- READ: Chap. 7 WE, Tables & Graphics in Reports

Due: Flow Chart (for controller code for robot strategy - may be pseudo code)

Deadline: Performance Test 3 – Teams must demonstrate controller operation of chassis including maneuvering using GPS, bump or other sensors. Robots must start when the CdS cell detects the start light, drive down the ramp, activate the detonator, drive up the ramp to the center section, and touch a rock. Optional: Teams may also demonstrate the ability to determine their heading angle by reading the RF signal and displaying the current heading angle on the Handy Board LCD.

WEEK 6

Monday, May 4

- Lecture W06 D01 – Documenting robot electrical system, Guidelines for Performance Test
- Work on robots

Due: Draft of final report sections assigned in Week 5

Wednesday, May 6

- Lecture W06 D02 – Documentation lecture topic: Data analysis and presentation
- Work on robots
- **Laboratory quiz**

Friday, May 8

- Lecture W06 D03 – A look ahead to Week 7, Reminder of Draft Report due on Monday
- Work on robots
- Teams meet with faculty to discuss progress
- READ: Chap. 9 WE – Engineering Your Presentation

Due: Sketches of robot's electrical system and sensors

Deadline: Performance Test 4 – Teams must demonstrate a functional pick-up and identification mechanism for the rock and a drop-off mechanism for the dynamite. Robots must start when the CdS cell detects the start light, drive down the ramp, drop off the dynamite, activate the detonator, drive up the ramp to the center section, and pick up the rock. After this, the robot must detect and display the color of the sample on the Handy Board LCD.

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WEEK 7

Monday, May 11

- Lecture W07 D01 – Documentation lecture topic: Oral Reports
- Work on robots

Wednesday, May 13

- Lecture W07 D02 – Requirements for Performance Test 5
- Work on robots

Due: Draft of final report sections assigned in Week 6

Friday, May 15

- Lecture W07 D03 – A look ahead to individual competition, Team peer evaluation #2
- Work on robots
- Teams meet with faculty to discuss progress

Deadline: Performance Test 5 – Solid model of the robot required. Teams must demonstrate the capability to gather and deposit the rock and maneuver to the retaining wall. Robots must start when the CdS cell detects the start light, drive down the ramp, pick up the rock, deposit it into either bin, display the color of that bin on the Handy Board LCD and touch the retaining wall.

Tasks can be completed in any order.

WEEK 8

Monday, May 18

- Lecture W08 D01 - Documentation lecture topic: Visual aids
- Work on robots

Due: Outline of oral report

Due: Team Peer Evaluation #2 Due (Not for grade)

Wednesday, May 20

- Lecture W08 D02 – Guidelines for Individual Competition
- **INDIVIDUAL COMPETITION**, held in class **(Scores to be used for seeding for final competition)**

Friday, May 22

- Lecture W08 D03 – A look ahead to the end of the quarter
- Work on robots
- Teams meet with faculty to discuss progress

WEEK 9

Monday, May 25

- **Memorial Day – No Classes, but labs may be open – check schedule**

Wednesday, May 27

- Lecture W09 D01 – Schedule for the last two weeks
- Lecture W09 D02 – Last minute discussions of competition on Thursday
- Fine tune robots

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WEEK 9 (Continued)

Thursday, May 28

- **HEAD-TO-HEAD / FINAL COMPETITION** at St. John Arena – Tournament begins at 4pm.
- ***There will be preliminary rounds starting at around noon and going to ~3pm.***

Friday, May 29

- Lecture W09 D03 – Review of Written and Oral Report Requirements
- Robot Technical Inspection and Budget Reconciliation
- Work on written and oral reports
- Check slides for Oral Report, Review Chap. 9 WE

WEEK 10

Monday, June 1

- Lecture W10 D01- Order of presentations on Wednesday, Rules for Presentations
- Practice Oral Presentations
- Work on Project Notebook and Final Report

Wednesday, June 3

- Lecture W10 D02 – Guidelines for Presentations
- **ORAL REPORT PRESENTATIONS**

Friday, June 5

- Lecture W10 D03 – Activities for the day, Wrap-up and course evaluation
- End of year FEH Social Festivity (5 p.m. to 7 p.m., picnic at the Ag Engineering Building)

Due: Written Reports and Notebooks

Due: Team Peer Evaluation #3 Due (For grade)

Due: Return Robot Starter Kit which includes - Controller with serial cables, power transformer, and interface board, USB to serial adapter, tool kit, textbook (*Robotic Explorations: A Hands-on Introduction to Engineering*, Fred Martin, Prentice-Hall, 2001) (See “Penalties” under Grading Criteria)

End of Quarter FEH Picnic – Food, Agricultural, & Biological Engineering Hi-Bay, Hosted by Shell

SOME USEFUL ON-LINE RESOURCES

The MIT Handy Board:

<http://handyboard.com/>

Robot related parts suppliers and info:

<http://www.acroname.com/index.html>

<http://www.mrrobot.com>

<http://www.robotstore.com>

<http://www-robotics.cs.umass.edu/intro.html>

<http://www.kipr.org/>

<http://www.erecortsets.com/>

ENGINEERING H193 DAILY SCHEDULE – SPRING QUARTER 2009

GRADING CRITERIA FOR ENGINEERING H193

Engineering Fundamentals:

<u>Team Assignments</u>	<u>Points</u>
Design Schedule	40
Progress Report	40
Outline of Final Report	20
Draft of 1 st Part of Final Report	40
Draft of 2 nd Part of Final Report	40
Outline of Oral Presentation	20
Oral Presentation/Report	100
Written Final Report	100
Project Notebook	<u>50</u>
Sub TOTAL	450

Engineering Laboratory:

<u>Individual Assignments</u>	<u>Points</u>
*Controller Lab Report #1	40
*Motor Lab Report	40
*Controller Lab Report #2	40
*Lab Quiz	50
 <u>Team Assignments</u>	
Brainstorming list, sketches, strategy	30
Chassis sketches & calculations	30
Power train sketches & calculations	30
Flow chart / pseudocode	30
Sketches of electrical system & sensors	30
Performance Test 1: Chassis w/Wheels or treads	20
Performance Test 2: Chassis w/Motor & Drive Up Ramp	20 (includes 5 pts for solid model)
Performance Test 3: Start w/Light & Maneuver	20
Performance Test 4: Blow Stuff Up & Identify Rock	20
Performance Test 5: Deposit Rock & Touch Wall	<u>20</u> (includes 5 pts for solid model)
Sub TOTAL	420

Competition (See Contest Rules for Bonuses):

<u>Team Effort</u>	<u>Points</u>
Individual Competition	50
Head-to-Head Competition	<u>80</u>
Sub TOTAL	130
 TOTAL Points for Course	 1000

Bonus – 30 points if all team members each submit journal entries in each week on time for 8 out of the 10 weeks.

Bonus – Additional points as specified in design contest rules.

Please NOTE: There is no final exam in Engineering H193!!!

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GRADING CRITERIA - PENALTIES

1. At the end of each class period, lab equipment and tools used by each team are to be returned to their proper location. Each time they are not returned, each member of the team loses 5 points. All work areas will be cleaned after use. If not, each member of the team loses 5 points
2. On the last day of regularly scheduled classes, teams are to return the tool kits, textbooks, manuals, controllers, serial cables, power transformers, and interface boards to the FEH staff. Failure to return any one of the items will cause all members of the team to receive an Incomplete in the course. A replacement-cost charge will be assessed for missing items.

A NOTE TO THE STUDENT

The process of engineering design is more than just tinkering...it is the logical application of scientific principles to a tangible design. It involves creativity, dedication, thought, research, ingenuity, and work. The purpose of this design project is to introduce you, the student, to the principles and practices involved in an engineering design project. It may very well be your first experience in "real world" engineering. This course will be quite different from any you may have taken thus far, and will give you experience in areas that other courses cannot. This quarter, you will be required to design and build a robot. You will be evaluated during all phases of the development work. Your grade will reflect a combination of your performance in the design process, your demonstration of both written and verbal communication skills, your ability to work in a team environment, and the performance of your team's robot in the contest. It will be predominately a team effort. Therefore, a good grade can only be achieved by working out a competent design and then implementing it as a team.

Accrediting Board for Engineering and Technology (ABET) - Program Criteria:

ABET Criteria	Introduced in FEH program		
	Autumn	Winter	Spring
Engineering programs must demonstrate that their graduates have:			
(a) an ability to apply knowledge of mathematics, science, and engineering	Yes	Yes	Yes
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	Yes	Yes	Yes
(c) an ability to design a system, component, or process to meet desired needs	Yes	Yes	Yes
(d) ability to function on multi-disciplinary teams	Yes	Yes	Yes
(e) an ability to identify, formulate, and solve engineering problems	Yes	Yes	Yes
(f) an understanding of professional and ethical responsibility	Yes		Yes
(g) an ability to communicate effectively	Yes	Yes	Yes
(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	Yes		Yes
(j) a knowledge of contemporary issues			
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Yes	Yes	Yes

UNIVERSITY & FIRST-YEAR ENGINEERING PROGRAM POLICIES

Course Safety Policy. Classroom/Lab/Shop Safety Rules are intended to minimize the opportunity for accidents or injuries during any time the student is in the classroom, the open lab, or the design project machine shop. These classroom/lab/shop safety rules must be followed with no exceptions. Students who fail to adhere to these safety rules will be asked to leave the class, lab, or shop.

The Classroom/Lab/Shop Safety rules are:

- No dangling jewelry or loose clothes.
- No open-toe footwear of any kind. (You will be asked to leave and return with closed-toe shoes).
- Be careful with sharp corners.
- Eye protection will be provided and required for some activities. Eye protection is mandatory for all persons in the design project machine shop.
- Note location of phone and first-aid kit.
- Report ALL injuries to the instructional staff.
- No food or drink in any classroom, lab, or shop space.

Academic Misconduct such as cheating or plagiarism will be reported using official University procedures. Policies and procedures can be found the Code of Student Conduct available online in several places including http://studentaffairs.osu.edu/resource_csc.asp. The Code of Student Conduct is also printed in the Student Handbook and Student Telephone Directory. Copies may be obtained from the Office of Student Judicial Affairs.

- All cases of suspected misconduct must be reported to the University Committee on Misconduct. Any students observing misconduct should report such to the course instructor.
- The Code of Student Conduct defines Academic misconduct to include
 - Violation of course rules
 - Providing or receiving information during quizzes or exams
 - Submitting plagiarized work
 - Falsification, fabrication, or dishonesty in reporting research or experimental results
- As a student, you need to know that faculty members are obligated to report all misconduct cases to the University Committee on Academic Misconduct. This is not an option.
- For purposes of Academic Misconduct in any reported cases in any First-year Engineering Program course, the College of Engineering's Director of the Engineering Education Innovation Center will act as the Department Chair.
- It is acknowledged that the First-Year Engineering Program encourages collaboration among students on some assignments from time to time. However, when an assignment is identified as an individual assignment, the work turned in by an individual must be the product of that person.

Tests Faculty May Use to Determine Individual Product:

- Can you explain and demonstrate how you did each step or element of a problem or exercise?
- Is the work shown in your own words and terms, or was the electronic file created by you?
- Can each team member produce the end product for himself or herself as an individual or explain the process involved?

Excerpt from the Code of Student Conduct: 3335-23-04 Prohibited conduct:

Any student found to have engaged in the following conduct while within the university's jurisdiction, as set forth in section 3335-23-02, will be subject to disciplinary action by the university.

A. Academic misconduct

Any activity that tends to compromise the academic integrity of the university, or subvert the educational process. Examples of academic misconduct include, but are not limited to:

1. Violation of course rules as contained in the course syllabus or other information provided to the student; violation of program regulations as established by departmental committees and made available to students;

UNIVERSITY & FIRST-YEAR ENGINEERING PROGRAM POLICIES

2. Knowingly providing or receiving information during examinations such as course examinations and candidacy examinations; or the possession and/or use of unauthorized materials during those examinations;
3. Knowingly providing or using assistance in the laboratory, on field work, or on a course assignment unless such assistance has specifically been authorized;
4. Submitting plagiarized work for an academic requirement. Plagiarism is the representation of another's work or ideas as one's own; it includes the unacknowledged word-for-word use and/or paraphrasing of another person's work, and/or the inappropriate unacknowledged use of another person's ideas;
5. Submitting substantially the same work to satisfy requirements for one course that has been submitted in satisfaction of requirements for another course, without permission of the instructor of the course for which the work is being submitted;
6. Falsification, fabrication, or dishonesty in reporting laboratory and/or research results;
7. Serving as, or enlisting the assistance of a substitute for a student in the taking of examinations;
8. Alteration of grades or marks by the student in an effort to change the earned grade or credit;
9. Alteration of academically-related university forms or records, or unauthorized use of those forms; and
10. Engaging in activities that unfairly place other students at a disadvantage, such as taking, hiding or altering resource material, or manipulating a grading system.

Source: http://studentaffairs.osu.edu/resource_csc.asp

For Students with Disabilities. Please note that course materials and exercises can be made available in alternative formats. Please contact the instructor or the Office for Disability Services (292-3307) for further information.

Ohio State Sexual Harassment Policy. The University administration, faculty, staff, student employees, and volunteers are responsible for assuring that the University maintains an environment for work and study free from sexual harassment. Sexual harassment is unlawful and impedes the realization of the University's mission of distinction in education, scholarship, and service. Sexual harassment violates the dignity of individuals and will not be tolerated. The University community seeks to eliminate sexual harassment through education and by encouraging faculty, staff, student employees, and volunteers to report concerns or complaints. Prompt corrective measures will be taken to stop sexual harassment whenever it occurs.

Source: <http://hr.osu.edu/policy/policy115.pdf>

Student Permission for First-Year Engineering Program Publicity. During participation in the First-Year Engineering Program, photographs, printed material and videotapes may be made for the purpose of informing the university community and the general public about activities in the College. Student images in the above media may be used to promote College programs and to make public announcements of student accomplishments and those of other students. If you do not wish for your image to be used, please contact Becky Garber in 244C Hitchcock Hall or at Garber.61@osu.edu.