ENG PHYS 4A06
Design and Synthesis Project
Fall/Winter 2017/2018
Course Outline

Instructor Office Hours and Contact Information

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Term 1:

	Monday	Tuesday	Wednesday	Thursday	Friday
09:30	Office Hour!	Office Hour!	3O04 BSB/121	Office Hour!	2P BSB/244&9
10:30	2P04 Prep	Office Hour!	2P/3O Prep	Office Hour!	2P BSB/244&9
11:30	2P04 BSB/137	3O04 Prep	2P04 BSB/137	Office Hour!	2P/3O Prep
12:30	Office Hour!	3O04 BSB/115	3O04 BSB/115	Office Hour!	3O04 BSB/115
13:30	Check	Check	Check	Office Hour!	2P04 BSB/137
14:30	Check	Check	Check	Office Hour!	Check
15:30	Check	Check	Check	Office Hour!	Check
16:30	Check	Check	Check	Office Hour!	Check

Term 2:

	Monday	Tuesday	Wednesday	Thursday	Friday
09:30	Office Hour!	Office Hour!	Office Hour!	Office Hour!	Office Hour!
10:30	2E04 Prep	Office Hour!	2E04 Prep	Office Hour!	Office Hour!
11:30	2E04 ABB/102	Office Hour!	2E04 ABB/102	Office Hour!	Office Hour!
12:30	Office Hour!	Office Hour!	Office Hour!	Office Hour!	2E04 Prep
13:30	Check	Check	Check	Office Hour!	2E04 ABB/102
14:30	Check	Check	Check	Office Hour!	Check
15:30	Check	Check	Check	Office Hour!	Check
16:30	Check	Check	Check	Office Hour!	Check

Note: The "Check" times may *also* be office hours – please feel free to drop in if I'm here. However, these times are sometimes used by irregular meetings or course deliverables. You can email me to make sure I'll be available and/or to reserve any "Office Hour!" or "Check" time for you or your group. I will always be present during an "Office Hour!" time, emergencies notwithstanding.

Teaching Assistants

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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

Avenue to Learn (ATL) http://avenue.mcmaster.ca/ is the primary means of distributing information for 4A06. Set up ATL to email you with news postings for 4A06 so you get notified. For group/individual communications, you will be emailed directly.

INTENDED LEARNING OUTCOMES

By the end of 4A06 you will have achieved the following learning outcomes:

1. Understand how to apply your undergrad Eng Phys knowledge to physically CDIO (conceive, design, implement, and operate) a physical device,
2. Have a large amount of technical knowledge and engineering skill relevant to your particular project and your role within your group (while the exact technical knowledge & skill gained will be different for everyone, everyone will definitely gain a lot of it),
3. *Know* how to recognize when you need to seek external information, and have the confidence, attitude, and skill to independently *seek it*. (Become a person who takes pride in knowing things; who takes the initiative to learn things even when no one tells you to.)
4. Be able to effectively work in an engineering team including
    a. Give effective team member feedback
    b. Use team member feedback about yourself to improve
    c. Communicate effectively with team members
5. Convey information about your inventions in a modern engineering world, including
    a. In a technical seminar (demos),
    b. In a tradeshow format (capstone expo), and
    c. Via social media (creating a YouTube commercial).

These learning outcomes combined are demonstrated by your successful engineering (CDIO) of a new device to solve a real world problem.

ASSESSMENT

Component	Weight (%)
Practice Pitch Presentations	1% (0.5% each * 2)
Project Status Reports	8% (0.5% each * 16)
Shark Den	2%
PSR+: Minnick Meetings / Peer Feedback	4% (0.5% each * 8)
Module Demo	10%*
Integration Demo	15%*
Optimization Demo	20%*
Final Report & Video	20%
Capstone Expo	20%*
Design Competition	1-20% Bonus
Total	100%
Modified by: Fraction of a Fair Contribution for your group you personally did averaged over the entire course as assessed by your TA & your Peer Evaluations	Multiplier

DESIGN COMPETITIONS

Entering your device in design competitions and competing in them is strongly encouraged, and has the potential to earn bonus marks each time you compete and each time you win. The bonus marks available for competing and winning depend on the particular competition, so speak with Dr. Minnick to find out what you can expect for the competition(s) you're considering.

PERFORMANCE MARK CAPS

The Project Status Reports, Demos, and Capstone Expo are not capped at 100%. To earn more than 100% on a PSR demonstrate to your TA that your team is ahead of schedule for meeting your project goals. To earn more than 100% on a demo or the expo, surpass your project objectives. See the relevant sections on these deliverables for details.

EPA SCORE

Several items in the course (Pitches, Demos, and the Expo) are marked using a metric called the EPA (**E**ngineering Challenge, **P**erformance, **A**ppeal) score. This is intended to fairly mark project goals of varying difficulty and encourage projects which are appealing to society, while not being quite as brutal as raw performance marking for projects which don't completely achieve their performance goals. The EPA score is calculated by multiplying your score on each of the three categories and then taking the cube root (so that 80% on each means 80% overall rather than 51%!). The categories are defined as:

1. Engineering Challenge: How challenging is the Engineering which needs to go into achieving your Goals (independent of what fraction of them you've actually achieved)
2. Performance: What fraction of your promised performance goals have you demonstrated?
    a. For the Pitch Presentations, your clients will grade your performance based on their *expectations* of how successful you will be at achieving your goals as presented. For this reason, you should

illustrate that you're very clear on the challenges your project entails and have the skills, plans, and motivation to overcome them.

b. For the Module & Integration demos the relevant performance metrics are the ones laid out for them specifically in your DOS.

3. Appeal: how useful / desirable / interesting does your project as-presented appear to society?
    a. "Society" here is broadly defined; a project can have high appeal if it's something everyone would want in their home, if it would be used by environmental groups to help save an endangered species, if it has a useful niche industrial application, or even if it's a cool toy.
    b. Appeal can suffer if
        i. your target device isn't useful to society,
        ii. your prototype doesn't work, or
        iii. you don't present clearly enough that people understand it.

Speak to your client (TA) often to make sure you're on the same page about what marks you can expect them to give you. Dr. Minnick is available to mediate discussions with your TA about this and even overrule them in extreme cases.

The End-of-Term Fair-Work-Fraction Grade Multiplier

For the entire course almost all deliverables are group deliverables and all marks received are group marks. However, after your group mark is calculated your TA will make a case for how much of a fair of a contribution to your project you made relative to a 100% fair contribution for your particular group (maximum 125%, minimum 0%). Your TA will back up this case with evidence from your PSR booklet, and your group's peer assessments over the course. Your final mark in the course will be this fraction of a fair contribution multiplied by your final group mark.

*Demo Reweight Option

After the Optimization Demo your group may opt to permanently move any fraction of the weight of any demo to the Capstone Expo, as long as your total score on that demo was at least 30%.

Details:

1. You can select 1, 2, or all 3 demos for this, and can set the fractions to move separately for each.
2. All members of your group receive the same reweight, so the entire group must come to a consensus.
3. To select your reweight option, email your TA no later than 1 week after the Optimization Demo with all of your group members cc'd, stating "We opt to move 50% of the Module Demo, 0% of the Integration Demo, and 100% of the Optimization Demo to the Capstone Expo." (with the percentages adjusted to your actual selection)

Note that the EPA standard for the Expo is identical to that for the Optimization Demo except that for the Expo:

1. Your project is evaluated all day (This doesn't mean your device needs to continuously work all day; it's more forgiving than the 10 minute time limit of the Demos if you have a glitch that you sort out later in the day.)
2. The Appeal part of your EPA score is more based on how appealing your device comes across to the attendees than to your TA like it was for the Demo.

COURSE SCHEDULE & DELIVERABLES

See the subsections after the schedule for an explanation of each deliverable.

Date	Topic / Deliverable	Location
Tue 5 Sep 2017	**Intro Lecture**	**BSB/B101**
	Pitch Ideas to Instructor	BSB/B106
Tue 12 Sep 2017	**Practice Pitch #1**	**BSB/B101**
	Pitch Ideas to Instructor	BSB/B106
Tue 19 Sep 2017	**Practice Pitch #2**	**BSB/B101**
	Shark Den Prep with Instructor	BSB/B106
Tue 26 Sep 2017	**Shark Den**	**BSB/B101**
	DOS Finalize with Instructor & TA	BSB/B106
Tue 3 Oct 2017	PSR, receive toolkits. Safety Quiz, DOS, Individual Expression of Interest, and Problem Statement section of Final Report due	**BSB/B101**
Tue 10 Oct 2017	*Mid-term recess*	
(At least once since last PSR+)	Meet Instructor for Tech Support	BSB/B106
(During the week before PSR+)	Peer Assessment	
Tue 17 Oct 2017	**PSR+**	BSB/B101
Tue 24 Oct 2017	PSR	BSB/B101
Tue 31 Oct 2017	PSR	BSB/B101
Tue 7 Nov 2017	PSR, Draft of Design for X sections of Final Report with one example for each	BSB/B101
Tue 14 Nov 2017	PSR, Team Name, Team Logo, and project description for promotional material due	BSB/B101
Tue 21 Nov 2017	**Module Demo**	**BSB/B101**
Tue 28 Nov 2017	PSR, Mid-Course Assessment, Mathematical Modelling section of Final Report	BSB/B101
(At least once since last PSR+)	Meet Instructor for Tech Support	BSB/B106
(During the week before PSR+)	Peer Assessment	
Tue 5 Dec 2017	**PSR+, Mid-Course Assessment Take-up & End-of-Term Pizza Party (if 80% completion of Mid-Course Assessment)**	**BSB/B101**
Fri 8 Dec 2017 - Thurs 4 Jan 2018	*First-term Exams and Recess*	
Tue 9 Jan 2018	PSR, Circuit schematic, sample waveform, and PCB layout section of Final Report due (for at least one nontrivial circuit)	BSB/B101

Tue 16 Jan 2018	PSR, Mechanical drawing section of Final Report due (for at least one nontrivial component)	BSB/B101
Tue 23 Jan 2018	**Integration Demo**	**BSB/B101**
Tue 30 Jan 2018	PSR	BSB/B101
(At least once since last PSR+)	Meet Instructor for Tech Support	BSB/B106
(During the week before PSR+)	Peer Assessment	
Tue 6 Feb 2018	**PSR+**	BSB/B101
Tue 13 Feb 2018	PSR	BSB/B101
Tue 20 Feb 2018	*Mid-term recess*	
Tue 27 Feb 2018	PSR	BSB/B101
Tue 6 Mar 2018	PSR	BSB/B101
Tue 13 Mar 2018	PSR	BSB/B101
Tue 20 Mar 2018	**Optimization Demo**	**BSB/B101**
(At least once since last PSR+)	Meet Instructor for Tech Support	BSB/B106
(During the week before PSR+)	Peer Assessment	
Tue 27 Mar 2018	**PSR+,** Report & Video Due for advance marking	BSB/B101
Tue 3 Apr 2018	**Report & Video Advance Marks Discussion with your TA, End-Of-Course Pizza Party (assuming 65% completion of Final Course Assessment)**	BSB/B101
Fri 6 Apr 2018	**Capstone Expo**	**MUSC Marketplace**
Fri 13 Apr 2018	**Report, Video, and Final Peer Assessment Due**	**Online**

PITCH PRESENTATIONS

The Pitch Presentations (Practice Pitch Presentation 1 & 2 and the Shark Den) are presentations your group makes to the class, your clients (TAs), your guide (Dr. Minnick), and (for the Shark Den only) to additional faculty and industry sponsors (who are donating money to fund your projects). You have exactly 5 minutes to explain specifically what you're proposing to build and why society should want you to do it. After your presentation the attendees will take 15 minutes to ask questions, offer suggestions, and give feedback.

PITCH PRESENTATION TIPS:

1. The rooms will be announced in advance, and it's in your best interest to ensure that your laptop can connect quickly to the projector so it doesn't cut into your time and impact your impression.
2. Sharks *will* look up competing products on their phones so be prepared to explain why your project is superior to existing solutions (at least in certain cases you're targeting).

3. Have your device significantly thought through; specifically, be ready to present a projected component list with suppliers and prices, algorithms you intend to use, etc. (You are not stuck to implementing it exactly the way that you pitch.)
4. Be specific with your target performance specs; How big is it? How heavy? How much will it cost? How fast does it achieve the task? With what precision? How long can it operate? etc.
5. Before your Shark Den pitch you should draft your OS and the Problem Statement from the Intro to your Final Report. Thinking the project objectives through to this detail will make your pitch much more effective.

DEVICE OBJECTIVE STATEMENT (DOS)

The DOS is to set your objectives for the device in writing; it's a promise to your client (TA) for what you're going to deliver at the end of the course (the Optimization Demo and the Expo). Be specific with your project's target specifications, including:

1. Task(s) your device will achieve, and the precision / speed / accuracy with which it achieves them
2. Required setup for your device to be able to do it (i.e., what the device expects about its environment for it to be able to complete its objective)
3. Target cost
4. Target size & weight
5. Target method of achieving the objective (i.e., the type of components it will use to achieve its objective. Be clear about where you will be purchasing materials to build a solution vs. purchasing a solution.)

The DOS is completed in cooperation with your client (TA) mediated by the course instructor during an instructor meeting. You are free to update the DOS using the same process (booking a meeting with your TA and Dr. Minnick) at any time during the course. Your TA will mark each PSR, each Demo, and the Expo based on what the DOS was at the time of that assessment. Once agreed on, your DOS will be printed out, signed by your group members, TA, and Dr. Minnick, and placed in your PSR binder. You need to make sure your up-to-date DOS is in your PSR binder to receive credit at your next PSR.

PROJECT STATUS REPORT (PSR)

A PSR is a report your group makes to your client (TA) about the status of your project. The process is as follows:

1. Write a group weekly letter (with a word processor):
    a. Includes the date
    b. Outlines what the state of the project is at the moment relative to the target project timeline (a Gantt chart or equivalent in your PSR binder)
    c. Outlines briefly what each group member accomplished since the last PSR
    d. Outlines what everyone is promising the client to do to be on schedule with the project for the next PSR
    e. Is signed by each group member
2. Place the weekly letter in your group's PSR Binder along with:
    a. any updated safety reports (see **Safety Reports**) ,
    b. updated Gantt charts,
    c. the DOS, and
    d. individual expression of interests.
3. Deliver the PSR binder to your TA at the start of your timeslot (to be announced on ATL)
4. Wait for the TA to look over the report.
5. Meet with the TA to discuss & demonstrate your project's status and hear feedback.

Marks for the PSR are based on where your project is relative to being on track. 100% if you're perfectly on track to the satisfaction of your client (TA), add/subtract 20% per week behind/ahead, minimum 0% (5 or more weeks behind) maximum 200% (5 or more weeks ahead). You must demonstrate your project status (i.e., show physical demos of performance, demonstrate that code works, show things you've built, address TA concerns you wrote down in the previous week, etc.) to receive credit.

PSR+

A PSR+ is a regular PSR plus a write-up of two other things:

1. Identifying at least one way your group has successfully received support from the instructor during instructor meetings since the last PSR+, and
2. An individual commitment for what you are going to do to improve in light of your peer feedback.

To receive the additional marks allocated to these items, you need to write them up. Before you can do that, you need to

1. Have enough meetings with Dr. Minnick to receive support (Dr. Minnick is not your boss or your client; he's your guide. Still, your best bet for getting the most support is to enter the meeting with the proactive attitude of an excellent employee: Bring a problem you're working on, what you've tried / found out about it so far, and what you're currently planning to do to solve it)
2. Complete the peer assessment on ITPMetrics no later than 1 day before the PSR+ (ideally earlier so your group can receive feedback in time to write their responses). Remember to be honest about your team members' performance on each assessment so that they have a chance to improve their performance when it can make a difference. Each assessment covers their performance since the last assessment; comments about their performance prior to that will be disregarded (you can't suddenly complain about a group member's October performance in April.)

The first PSR+ covers at least 5 instructor meetings (3 for Pitch preparation & project selection, 1 for finalizing the DOS, and at least one additional one for project support), but you don't need to summarize the support from the first 4 to receive marks for them - Just document when the meetings took place.

Individual Expression of Interest

After you complete your [first] DOS, each group member must write a paragraph explaining:

1. Why they want to do this project,
2. What they're particularly interested in about this project, and
3. What they promise both their client (TA) and their group members about what they personally will contribute to it.

You then print out this paragraph, date and sign it, and place it in your group's PSR binder next to your DOS along with the Individual Expressions of Interest of your group members.

Performance Demos

Throughout the year there are 3 Performance Demos:

1. Module Demo: have all of your individual modules (as outlined in your DOS) completed.
2. Integration Demo: have your modules working together to achieve your final objective, but not necessarily as reliably, quickly, accurately, etc. as required for your final project.
3. Optimization Demo: have your device working at the promised final performance level.

(For exact performance mark expectations be sure to talk to your TA in advance to make sure you're on the same page.) Plan to have your performance demonstrated in less than 10 minutes. You don't necessarily need to

demonstrate everything live in 10 minutes; instead, you can have [sped-up] videos prepared to demonstrate everything quickly (5 minutes) and be prepared to give a live demonstration as requested.

After your demo, your TA will decide your EPA scores based on their understanding of your DOS and your project status as-demonstrated (your E score will mostly be determined beforehand, but may change if the demo makes your TA realize your target project was different than they thought). Dr. Minnick will mediate discussions between TAs to help ensure that the TAs all have the same standards for marks, and can help mediate discussions between your group and TA on request.

Capstone Expo

The Capstone Expo is similar to an 8-hour Optimization Demo in the MUSC Marketplace, and evaluated the same way, except that your TA will consider how spectators viewed your project when determining your Appeal score, and will consider whether your device worked at least some of the time when determining your Performance score. Keep in mind that the final presentation of the course will have this format when deciding on your project, and when testing (the MUSC Marketplace has different lighting, flooring, noise, and wi-fi than the project room).

Video Commercial

The Video Commercial should be a 2- to 5-minute video uploaded to YouTube introducing your device, showing what it does & why society would want it, briefly showcasing the engineering work your group personally did to achieve it, and demonstrating its performance. You can look at past videos for 4A06 on ATL but feel free to innovate as long as you still achieve the video's purpose. This is a great thing to put on your resume to showcase the engineering work you did.

Final Report

The Final Report, like the Video Commercial and the Capstone Expo, is an end-of-year major deliverables of the course to summarize your project. Imagine that you are writing it for a client that has hired you to design your device for them. This will be used by future students of 4A06 to learn how to replicate portions of your work. Unlike a lab report, you don't need to explain the theory behind how ultrasonic sensors work, but you do want to explain any mathematical modelling you did to arrive at your design so that the client knows you did some good engineering. When writing parts of the final report refer to the section list below to know what to include, and the rubric below that to know what level is expected. You can also look at past final reports for 4A06 on ATL.

Final Report Section Content Description:

1. Title page with clickable link to your Video Commercial
2. Acknowledgement
3. Table of contents
4. Introduction, including:
    (i) statement of the problem your device solves, limitations of existing solutions, and motivation for a new one; 10
    (ii) brief overview of solution and brief description of the solution – what it is supposed to do; including how your solution meets objectives (things that you want to optimize) and constraints (things that must be present for the device to solve the problem); 10
5. Design:

For the following sections below (design for manufacturability, design for repair, design for reliability, design for safe fail, and design for life cycle) **define** each term and state how these features were incorporated into your design by **no more than three specific examples**. Refer to the drawings, schematics, and/or data that are included in the final report as necessary to substantiate the claims.

   (i) design for manufacturability 5
   (ii) design for repair 5
   (iii) design for reliability 5
   (iv) design for safe fail 5
   (v) design for life cycle 5
6. Mathematical Modelling (Present math and physics you did to make design choices for your project. Use modern engineering software where applicable. This is due early so that it can impact your device.) 25
   (i) Include: calculations that impacted your design, with an explanation of how they did that; i.e., math that your software is doing during operation, proof of concept math, physics you used to choose components, tune control systems, etc.
   (ii) Don't include: math without explaining how the result affected what you actually built or explanations of physical phenomenon as you would in the theory section of a lab report (assume your TA has a standard level of engineering knowledge)
7. Manufacture and assembly instructions – refer to mechanical drawings, schematic diagrams, exploded views, and/or photographs; assume that people know how to read engineering drawings; describe in detail only the non-standard operations 10
   (i) Refer to Appendix with: Bill of Materials (at reproducible prices from reputable retailers) 5
   (ii) Refer to Appendix with: Proper mechanical drawings done using a CAD software package (proper mechanical drawings for all parts that must be fabricated plus schematic and/or exploded views and/or photographs for assembly) 5
   (iii) Refer to Appendix with: Proper schematic diagrams of circuits done using a software package; all circuits must be on a PCB and analyzed using MultiSim or equivalent; include waveforms from analysis at test points; include copies of PCB mask/board with location of components 5
8. Operating instructions including a check list for operation 10
9. Environmental/health/safety code considerations - investigate and refer to relevant regulations, codes, etc. that apply to your project and how it complies with them 5
10. Précis of relevant information from MSDS for all materials and processes; include full MSDS in a compressed folder 5
11. Performance and Testing 25
   (i) Determine and substantiate your device's performance.
   (ii) Refer to Technical specifications and features datasheet Appendix
12. Conclusion and suggestions for improvements 10
13. Bibliography
14. Appendix A: Technical specifications and features datasheet: A table to give relevant dimensions, and performance measures, such as degree of meeting your objectives and constraints i.e.,
   (i) overall cost,
   (ii) power consumption,
   (iii) battery specifications,
   (iv) mass,
   (v) etc.
15. Appendices with commented code and other relevant information

In addition to the section marks, there are some mark categories for no section in particular:

1. Presentation and Formatting: 10
2. Overall Impression of the report and how well the project was done: 25

The final report & commercial video will constitute 15% of the grade. Only one report is required per group. Reports should be submitted via email in pdf format to your TA.

Final Report Marking Rubric

This describes the expected quality of each report section for various mark ranges; use in conjunction with the section content description above.

Level	1	2	3	4	
Section	Fails to Meet Expectations (0-49%)	Below Expectations (50-59%)	Meets Expectations (60-79%)	Exceeds Expectations (80-100%)	Marks
Intro: Problem Identification	Significant ambiguity in the problem or specifications	Some ambiguity in the project or specifications	Problem is clearly stated, specs adequately presented	Problem is clearly stated including all specifications and the solution is motivated very well	10
Intro: Solution Description	Unclear solution	Some ambiguity in the solution description	Solution clearly explained	Solution clearly explained including correct diagrams including tolerances, materials, and units where applicable	10
Mathematical Modelling	Mathematical model only partially developed or lacking, little to no analysis with modern engineering tools, model stability not addressed	Slight errors or ambiguity in mathematical model, somewhat lacking stability analysis	Mathematical modelling completed with little to no errors, used at least one modern design tool, made some study of robustness of model	Very clear and precise mathematical and physical modelling, used multiple simulation tools and adequately explored robustness of model resulting from them	25
"Design for" Sections	Minimal design process or justification	very few alternate designs considered, designs not explored fully, little software optimization	Some alternate designs critically considered, software partially optimized	Multiple designs critically considered, explored, and justified for all significant design choices, including software design choices and optimizations	25 total (5x5)
Manufacture / Assembly Instructions	Unclear assembly instructions	Somewhat ambiguous assembly instructions	Moderately clear assembly instructions	Very clear assembly instructions including pictures	10
Bill of Materials	Many parts missing or incorrectly sourced	Several parts missing or incorrectly sourced	Lists almost all materials correctly, but some inconsistent or suspect listings	Clearly lists all materials in accessible format, with reasonable vendors at correct quantities	5
Mechanical Drawings	Major errors or omissions in drawings	Drawings have several ambiguities or are insufficient for manufactured parts	Drawings correct with minor ambiguities	Drawings correctly dimensioned, materials listed, easy to use to reproduce device	5
Circuit Schematics	Major errors or omissions in schematics or testing	Several errors or omissions in testing or schematics	Schematics & testing complete with minor ambiguities	Complete schematics in accessible format along with testing for complete electrical picture of project	5
Operating Instructions	Unclear instructions	Somewhat ambiguous instructions	Mostly clear instructions	Very clear instructions	10
EHS Code Considerations	Absence of important relevant codes	Some missing codes or lack of relating it to your designs	Acceptable consideration of all relevant codes	Insightful consideration of all relevant codes and proof of design with them in mind	5

MSDS Précis	Key MSDSs missing or clearly misunderstood	Several MSDSs missing for parts of project, or improperly summarized	Nearly complete MSDS material summary	Key summary of all important MSDS information relevant to someone manufacturing and using your device	5
Performance and Testing	Many unjustified claims	Some claims unjustified, error analysis lacking, partially unclear explanation of whether performance goals were reached	Most claims justified with data, decent error analysis, clear explanation of performance reached	All claims justified with data, statements quantified, error analysis clear, clear explanation of performance reached	25
Conclusion	Very confusing conclusion with very weak future work proposals	Some confusion in conclusion, lacking future ideas	Clearly describes the project's success and wraps up report, ideas for improvements proposed	Inspiring wrap up that clearly describes the project's success, and proposes justified ideas for improvement	10
Presentation and Formatting	Significant errors in spelling or formatting, sections missing	Moderate errors in spelling or formatting	Some errors in spelling and formatting	Beautifully formatted, very few errors	10
Overall Impression	Unsatisfactory design and report	Marginally successful design and report	Adequate report and design carried out	Very impressive and robust solution, impressive report and design carried out	25
				Total	**185**

MATERIALS AND FEES

REQUIRED TEXTS:

- This Course Outline describes in detail the requirements for the course.
- Supporting technical information is available on Avenue to Learn.
- For refreshing their knowledge on the engineering design process, students could read chapters 3, 7, 11 and 12 of http://itll.colorado.edu/courses_workshops/geen_1400/resources/textbook/ ;
- For engineering ethics: http://www.peo.on.ca/index.php?ci_id=1815&la_id=1 .

Other Materials:

Lab equipment and consumables (limited amount provided).

FACILITIES

In the 4A06 project room there are oscilloscopes, power supplies, signal generators, soldering irons, a wifi connection, and a number of other useful tools and facilities. People working on Eng Phys 4A06 have priority, and no one who isn't in or responsible for 4A06 should be in the room without being accompanied by someone who is. See the Safety Quiz section for more details.

Each group will be signed out a toolkit with a number of useful hand tools. The toolkits need to be returned at the end of the course in working condition; you're responsible for the costs of any tools that need replacing due to loss or perceived misuse, but regular wear and tear over the course of 4A06 is expected.

You're expected to clean up after yourself, and when in doubt to clean up for others as well to keep the room in presentable fashion. The room needs to be cleared of any personal property and returned to a clean state before the reimbursements will be issued at the end of the year.

If replaceable supplies (e.g., shrink wrap, soap, paper towels, wire, etc.) in the 4A06 room have run out or nearly run out, email your TA and/or Chris to notify us to obtain more.

FUNDING

$150+/team is available to reimburse project costs (it will hopefully be more, depending on sponsor contributions). In March & April you'll receive some posts on ATL about how to submit the reimbursement form; for now, keep your receipts. In addition, the 4A06 room has a number of supplies available that will be of interest to everyone (cost sheet available on ATL). Talk to your TA for information.

STUDENT EXPECTATIONS

4A06 is a significant time commitment. In the past, on average, students have reported that they've personally spent 10 hours of real actual work on the project each week (i.e., about 300 hours total) outside of the group meeting times (i.e., presentations, weekly meeting with TAs, etc.). This is a huge amount of time, more than the unit count or classroom time would normally require. The most successful groups are usually those where:

1. group members all contributed equally (more or less), and
2. group members worked much more early in the course rather than at the end.

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only, and will not be taken into consideration in determining a student's actual grade in the course.

Outcomes	Indicators
Recognized and followed an engineering design process.	4.1
Recognized and followed engineering design principles including economic design principles. (Social aspects and safety to the public are not covered in this course)	4.2
Proposed solutions to open-ended problems	4.3
Employed appropriate techniques for generation of creative ideas such as brainstorming and structured inventive thinking.	4.4
Included appropriate health and safety considerations	4.5
Integrated standards, codes of practice and legal requirements relevant to the activity.	4.6
Evaluated and selected appropriate modern tools.	5.1
Was able to use modern/state-of-the-art tools.	5.2
Creates, adapts, modifies and extends tools and techniques as appropriate to solve problems.	5.3
Was able to manage time and processes effectively, prioritizing competing demands to achieve personal and team goals and objectives.	6.1
Developed and implemented processes and methodologies to manage the effectiveness of a team both in terms of the quality of the work produced by the team as well as the inter-personal relationships within the team.	6.2
Worked in a group, took a leadership role as appropriate and relinquished the leadership role as appropriate.	6.3
Demonstrated an ability to respond to technical and nontechnical instructions and questions	7.1
Presented instructions and information clearly and concisely as appropriate to the audience	7.2
Constructed effective oral or written arguments as appropriate to the circumstances	7.3
Applied economic principles in decision making	11.1
Planned and effectively managed time, resources, and scope	11.2

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity.

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca.

For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

NOTIFICATION OF STUDENT ABSENCES AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

1. The McMaster Student Absence Form is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note this tool cannot be used during any final examination period.
2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE/H301). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
6. You should expect to have academic commitments Monday through Saturday but not on Sunday or statutory holidays. If you require an accommodation to meet a religious obligation or to celebrate an important religious holiday, you may submit the Academic Accommodation for Religious, Indigenous and Spiritual Observances (RISO) Form to the Associate Dean's Office. You can find all paperwork needed here: http://www.eng.mcmaster.ca/current/documents.html

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

ON-LINE STATEMENT FOR COURSE REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using Avenue to Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to
http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf.

ATMOSPHERE

The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact their Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.

MACHINE SHOP

We have permission to use, under supervision, a subset of the equipment in the Engineering and Science Machine Shop in JHE-115. The lead hand of the Engineering and Science Machine Shop, Mr. Clealand Berwick, will instruct you on using the subset of equipment in the shop and will provide advice. Mr Berwick will be at the second course meeting. You must obey the safety rules, some of which are: wear safety glasses at all times; tie back loose hair, clothing, and jewellery; wear proper footwear – no open shoes or sandals; no bare legs; the shop supervisors have final authority over access to tools and equipment; and, all injuries and near misses are to be reported immediately to the shop supervisor. Suggestion: take a CAD drawing with you to the shop; this will reduce the time it takes to get started (dimensions should be in imperial measurement –i.e. inches and feet). You must attend a machine shop orientation session in the machine shop before you are permitted to use the facilities of the machine shop. Mr Berwick can provide information on registration. Register in the machine shop for the orientation sessions. The machine shop hours are 8:30 am to 12:00 noon and 1:00 pm to 4:00 pm, with breaks at 10:00 am and 2:30 pm. You are not permitted to use power tools during the breaks.

4A06-SPECIFIC SAFETY INFORMATION

LSH: A Laboratory Safety Handbook (LSH) and other safety information and links can be accessed at www.mcmaster.ca/CEDTsafety/ Databases of safety information can be accessed from a McMaster computer at http://ccinfoweb.ccohs.ca At this site, MSDS (material safety data sheets), Cheminfo, RTECS (registry of toxic effects of chemical substances), and bibliographic information are available.

Safety Quiz: Prior to accessing the 4A06 project room, you are required to watch the two safety videos and submit your safety quiz via the online drop box. You can do this at any time, but will not be granted access to the room until you do, so an effective deadline is the end of September.

Access: You may work in the 4A06 project room 24-7, but you must never work in the project room alone. Note that your keycards will not work overnight or on days where the university is closed (stat holidays and the 10 or so days

between 25 Dec and 1 Jan, see Sessional Dates on the McMaster Website for details), and that propping the door open will sound an alarm that security will respond to, likely kicking everyone out.

Food: Eating and drinking in the 4A06 room is only permitted in the central area, and only away from hazardous materials. Remember to wash your hands before and after eating or touching your face!

Safety Reports: Safety reports must be filed (in your weekly letter duotang) for materials and processes prior to first use! This includes but is not restricted to: lamps, LEDs, lasers, high-speed mechanical components, epoxy, glue, metal, composites, plastics, lubricants, solder, and soldering. To file a safety report is to include the report with your weekly progress demonstration to your TA. The safety report is to be a précis (i.e., a concise summary written in your words) of the relevant health and safety information (i.e., what are the risks, and what precautions do you need to take). Appropriate safety precautions and adherence to all regulations, codes, and practices must occur at all times. The safety reports are required for all materials worked with. You must cite where you obtained the information. Ask your TA whether something warrants a safety report. If asking your TA is not possible, assume it does.

Breakers: Note that the electrical breakers for BSB/B101 are located in BSB/B102, so students that trip breakers should notify Chris immediately.

Cameras: The 4A06 room is subject to video surveillance, but the video feed is not watched until after the fact where necessary. In the event of an emergency, call security (88 or 905-522-4135) rather than waving your arms at the cameras.

ADDITIONAL LAB SAFETY INFORMATION

INTRODUCTION

This document describes the application of McMaster's Workplace Environmental Health and Safety Policy to the particular situation of undergraduate labs in the Engineering Physics Department. The policy is written for students, but applies to all people involved in the labs.
McMaster's Workplace Environmental Health and Safety Policy is reviewed by the Central Joint Health and Safety Committee each year as well as signed by our University President.
The policy applies to students, visitors and volunteers.
The policy is available at http://www.workingatmcmaster.ca/eohss/prevention/policy/

CHAIN OF REPORTING FOR SAFETY TRAINING AND RESPONSIBILITY

You will be provided with a health and safety lecture at the beginning of the first lab. **You are responsible for ensuring that you understand this safety information.** The lab technician is responsible for ensuring that all equipment is in good working order. In the event of an emergency, notify your Teaching Assistant (TA) and the lab technician. They are responsible for calling medical aid if needed.
You must report any hazardous situation of concern to one level up according to the chart below. In case this person is not available, either contact the person delegated in their absence or the person positioned at the next level up. **You are expected to know this chain of reporting.**

DEPARTMENT CHAIR

Ray LaPierre (X 27764)

↑

INSTRUCTOR

Matt Minnick (X 24546, minnick@mcmaster.ca)

↑

LAB TECHNICIAN

Chris Mitchelitis (X 22657) or Peter Jonasson (X 24935)

↑

TA

Kyle Ansilio	**Garik Patterson**	**Michael Tucker**
ansilikf@mcmaster.ca	pattergg@mcmaster.ca	tuckerm@mcmaster.ca

↑

STUDENT (YOU)

FIGURE 1. CHAIN OF COMMAND FOR HAZARD REPORTING.

PROPER LAB BEHAVIOUR

Everyone in the lab is responsible for their own safety as well as the safety of others.

GENERAL GUIDELINES

1. Conduct yourself in a **responsible** manner at all times in the laboratory.
2. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, **ASK YOUR TA or LAB TECHNICIAN BEFORE PROCEEDING WITH THE ACTIVITY.**
3. **Never work alone** in the laboratory.
4. Perform only those experiments indicated by the lab manual or your TA/lab technician. Carefully **follow all instructions**, both written and oral. Unauthorized experiments are not allowed.
5. **Do not eat** food or drink beverages outside of the designated area in the laboratory. Do not use laboratory glassware as containers for food or beverages.
6. **Be prepared** for your work in the laboratory. Read all procedures thoroughly before entering the laboratory. Never fool around in the laboratory. Horseplay, practical jokes, and pranks are dangerous and prohibited.
7. Observe good housekeeping practices. Work areas should be kept **clean and tidy** at all times. Keep backpacks and overcoats out of traffic areas.
8. **Be alert** and proceed with caution at all times in the laboratory. Notify the TA or lab technician immediately of any unsafe conditions you observe.
9. Labels and equipment instructions must be read carefully. Set up and **use the equipment as directed** by your lab manual.
10. Experiments must be personally monitored at all times. Do not wander around the room, distract other students, startle other students or interfere with the laboratory experiments of others.
11. **Dress properly** during a laboratory activity. Long hair, dangling jewelry, and loose or baggy clothing are a hazard in the laboratory. Long hair must be tied back, and dangling jewelry and baggy clothing must be secured. **Proper footwear** must be worn, no flip flops, high heels, roller blades, etc..

12. **Report any accident** (spill, breakage, etc.) or injury (cut, burn, etc.) to the TA or lab technician immediately, no matter how trivial it seems.
13. **Cell phones and use of music headphones should be avoided** while working in the lab. They can be distracting and thereby increase the potential for an accident to occur.
14. Do not store food and drinks in refrigerators that are for lab supplies and vice versa (The refrigerator in BSB/B101 is ONLY for food & drinks)
15. For specific safety guidelines (e.g., electrical, chemical, etc.), consult your lab manual and McMaster's lab safety handbook: http://www.workingatmcmaster.ca/med/document/Lab-Safety-Handbook-1-36.pdf

PROCEDURE TO FOLLOW IN THE CASE OF AN ACCIDENT

Know the locations and operating procedures of all safety equipment including: first aid kit(s), and fire extinguisher. Know where the fire alarm and the exits are located.

Know what to do if there is a fire drill during a laboratory period; turn off any electrical equipment in the event of a fire drill and leave the building.

In the case of an accident, notify your TA and the lab technician immediately. They will phone the emergency extension **88** in the event of an accident. Remain until medical aid arrives. If the TA or lab technician is unavailable, dial **88** yourself from a campus phone or 905-522-4135 (Security).