AN INTRODUCTION TO ENGINEERING
VG100, SECTION 1 – SUMMER 2018

0. WHAT IS THIS CLASS?

You are enrolled in what will be a challenging (yet rewarding!) course designed to bring together students to address some basic issues facing engineers today. In addition to introducing basic scientific skills, this course will survey broad aspects of engineering, including their economic, ethical, legal, societal, and technological implications. Given your instructor's particular predilection, we learn many of the facets of engineering by their application to human bodies and human problems. We hope this course provides you with some insights into the ever-expanding realms of engineering.

As another one of the unique opportunities of this course, you (as part of a team) will construct a simple medical device and improve it in some meaningful way. You will conduct an investigative study to identify at least one unmet need from among the subset of all possible human problems w/r/t said medical device. This will be a team project that requires you to develop new skills, engage resources, and systematically address issues. In the space of one short summer semester, you will begin to think, operate, and communicate as engineers.

1. WHEN AND WHERE DOES THIS CLASS MEET?

Lectures: Tuesdays and Thursdays, 10:00 – 11:40 a.m., E1-107
(Weeks 6 – 11) Mondays, 10:00 – 11:40 a.m., E1-107
Labs: Tuesday, 6:20 – 8:00 p.m., JI General Engr. Lab 1
       Wednesday, 12:10 – 1:50 p.m., JI General Engr. Lab 1

2. WHO TEACHES THIS CLASS AND HOW DO YOU REACH THEM?

TECHNICAL

Barry Belmont
Biomedical Engineering
University of Michigan
440B UM-SJTU Joint Institute
E-mail: belmont@umich.edu
WeChat: barrybelmont
OH: Tues (12–1); Wed (11–12)

TECHNICAL COMMUNICATION

Tom Bowden
Technical Communication
University of Michigan
407B UM-SJTU Joint Institute
E-mail: tebowden@umich.edu

THE AIDES

Zhan Yan
ramseyzhan@sjtu.edu.cn
OH: Wed (10–12)

Zhang Zixiao
zixiaoxx@umich.edu
OH: Tues (6–7)

Xue Linkai
xuelinkai@sjtu.edu.cn

Xu Huilin
xhil9970616@sjtu.edu.cn
3. WHAT IS REQUIRED FOR THIS CLASS?

AN ARDUINO STARTER KIT
I recommend the Elegoo Uno R3 Project kit, but many equivalents are available. If you have any questions about which kit to purchase, please contact an instructor or an aide. You may share your kit with others so long as it is not to the detriment of your own work.

WRITING MATERIALS
A good pen and some sheets of paper ought to do.

ACCESS TO THE INTERNET PERIODICALLY
A good bulk of our class’s administration will be done through Canvas. Check it regularly.

4. WHAT DETERMINES THE GRADE ONE RECEIVES IN THIS CLASS?

THE ABJECT MATERIAL OF THE THING
Your grade is determined through a combination of individual and collective work whose assessment type, weight on total grade, and focus are as follows:

- Homeworks (4 assigned) 20% Individual, Technical
- Quizzes (online) 20% Individual, Tech. Comm.
- Participation 5% Individual
- Progress Reports 20% Team, Tech. Comm.
- The Project 25% Team, Technical

THE LARGELY ARBITRARY, BUT NEVERTHELESS SIGNIFICANT SCALE BY WHICH SAID GRADE WILL BE MEASURED BY AFOREMENTIONED INSTRUCTORS
As this is one of your instructor’s first time teaching this course, some calibration (on a per assignment and/or class-wide basis) may be required. That said, the class will be graded just as you might expect any other engineering class to be against the following scale:

- A+ ≥ 97; A ≥ 94; A- ≥ 90; B+ ≥ 87; B ≥ 84; B- ≥ 80; C+ ≥ 77; C ≥ 74; C- ≥ 70; D ≥ 60; F ≥ 50

THE POLICY REGARDING MISSED ChANCES, DO-OVERS, AND DISHONESTY
If you will be absent for or otherwise unable to complete some key assignment, let the instructors know ahead of time and we can work something out. If you feel an assessment of your work was wrong, misguided, or unfair, let the instructors know immediately and specifically and we will work something out. If you insist at any point on swindling yourself out of an honest education, please reconsider your decisions to do so (perhaps by discussing the matter with your instructor), otherwise this whole engineering thing for you is not going to work out.

5. WHAT IS THE DESIGN PROJECT?

Details of the project will be given during the course of the semester. However, in its broadest strokes you will be using an Arduino-based circuit to collect electrical activity from the heart. The first time you do this (Part A), we will all be building similar things. The second time (Part B), the design will be what you, your team, and your collective ingenuities and fortitudes make of it. Performance on these two parts will account for approximately 25% of your total grade. Take it seriously, but try to have fun with it.
6. WHAT IS THE HONOR CODE AND WHY SHOULD I NOT VIOLATE IT?

All students in this class are presumed to be decent and honorable human beings. That said, they are still bound by the Honor Code of the UM-SJTU Joint Institute. In short it states that you will not lie, steal, defraud, cheat, and/or swindle yourself and/or others out of an honest education. Specifically, you may not seek to gain an unfair advantage over your fellow students, you may not consult/use/possess unpublished work of another without their permission, and you must appropriately acknowledge your used of another’s work. More details on the police may be found at http://umji.sjtu.edu.cn/honorcode.

Should you decide at any point to violate the trust we place in you, we reserve to take whatever disciplinary action we believe to be necessary under the provisions and in keeping with the spirit of the Honor Code. I once heard a man put such actions thusly: “If you cheat me, I will rededicate the rest of my life to ruining the rest of yours.” Perhaps I am not so extreme, but it does approximate my feelings towards dishonest students.

7. WHAT ARE THE LABORATORY SAFETY GUIDELINES?

In this class you may work on projects that are dangerous if you are unaware of the specific hazards and neglect relevant precautions. The lab supervisor/manager, technicians, and instructors will ensure that you know of specific hazards and use personal protection equipment (PPE). PPE is available and must be worn at all times in the lab and when working on projects outside the lab. If working in your dormitory you are responsible for the personal safety of yourself and anyone entering the living space, and you must provide and ensure the use of PPE for all inhabitants of the living space including yourself.

Despite substantial efforts to ensure the completeness and correctness of the following safety guidelines, the instructors(s) cannot guarantee the accuracy of any of the information given herein, including but not limited to the resources & references, experimental illustrations, instructions, procedures, safety warnings and health protection instructions, safety guidelines, chemical disposal guidelines, or any portion of the guidelines. The students are urged to seek additional references to minimize errors, omissions, or any possible potential hazard or unsafe environment that may be present while working in the laboratory or on any portion of a project during or after any class period. Additional safety guidelines are also posted on CANVAS.

7.1. SAFETY ANNOUNCEMENT

“Substances used/handled during the term may carry health risks for certain students despite efforts to minimize any potential hazard. For example, certain students may have allergies related to some chemicals. If any student has particular health concerns, seek medical advice and decide whether to continue or drop the class.”

Any student involved in chemical handling and disposal are strongly urged to consult their chemical suppliers for detailed instructions for the disposal of individual chemicals. In addition, reviewing the government rules, regulations and literature are helpful. All persons are recommended to adhere to the strict government rules and regulations with respect to laboratory safety, health and environmental protection. Disposal of unauthorized chemical waste into the environment or drain system is prohibited by-laws. You are recommended to ensure safety and health standards for yourself and others. You should seek immediate help if you face any safety or health hazard issue, so please make sure you have in your possession a readily available emergency contact information of the local police, fire department and the nearest qualified emergency health care facility.
7.2. GENERAL LABORATORY SAFETY GUIDELINES

- Horseplay is forbidden. Please use common sense. No loud noises and yelling while others are working with the equipment.
- Do not work in the shop if you are impaired by drug or alcohol use, tired or in a hurry.
- Concentrate on your work. Distractions cause injury.
- Read and obey all operational signs and warnings.
- Adhere to the rules governing each individual machine.
- Do not operate equipment you are unfamiliar with. The only stupid question is the one that goes unasked. Seek help from shop staff. You may only operate equipment in which you have received proper training and obtained approval from the Lab supervisor.
- Only one person should operate a machine at any one time. Consultation at the machine is allowed but only one set of hands are on the machine.
- Do not try and stop machines with your hands. (Lathe chucks and drill press chucks) Wait for them to come to a stop.
- Never work by yourself. Another person must be in the machine shop area or supervising your work in the dormitory. (Student or Professional) It is unsafe!
- Do not sit while operating machines.
- Never leave a machine running and unattended.
- Machines must be shut off to remove tools and setups, before cleaning, and before modification.
- Ear protection appropriate for the frequency and intensity of acoustic emission will be worn when required in the laboratory.
- Report all broken tools and equipment to lab personnel.
- Do not use broken or dull tools.

7.3. BODY PROTECTION: EYES

- Always use eye protection (safety glasses, goggles or a face shield) when entering the shop and keep glasses/ goggles covering your eyes for the duration of your stay. Eye protection is also required if working in the dormitory.
- Both safety glasses and goggles are available in the laboratory. Prescription glasses with safety lenses are allowed if you have side shields.
- Use face shields when grinding or using fans with propeller blades.
- Use approved UV welding helmets/ glasses when welding or observing the welding process. It is your responsibility if welding to make sure observers are protected before striking an arc.
- Contact lenses with safety glasses are permissible when required in a lab. However, there are locations on campus where contact lenses are prohibited. Generally, it is bad practice to use contact lenses when there is a chemical splash hazard, even though goggles and/or a face shield are used.
- Chemical splash goggles and/or full face shields shall be worn during chemical transfers and handling operations as conditions dictate.
7.4. **BODY PROTECTION: CLOTHING**

- Closed toe shoes are required to enter the shop area. No sandals or flip flops.
- Bare feet are prohibited in any lab at any time. Sandals or open-web sneakers are prohibited in labs where chemical spills or falling of heavy objects present a hazard.
- Lab coats or aprons will be worn when chemical spills present a hazard.
- Short pants and skirts are prohibited.
- Do not wear rings, watches, necklaces or neckties while operating equipment.
- No loose fitting clothing that can be caught by rotating equipment.
- Long sleeves must be rolled up to the elbow.
- Long hair must be tied back and/or contained to avoid being caught in moving machinery or equipment. Caps are encouraged for containing long hair. Pony tails must be long enough to be put down your shirt, otherwise they must be contained.

7.5. **BODY PROTECTION: GUARDS**

- Do not remove machine guards.
- Do not wear gloves while operating rotating equipment. The gloves may get caught in the machine during operation.
- Do wear gloves to handle sheet metal.
- Keep hands away from sharp tools.
- Use of iPods or any kind of wired earphones is prohibited.

7.6. **GENERAL ELECTRICAL CIRCUITS SAFETY**

- Do not work alone on energized electrical equipment.
- Power must be switched off whenever an experiment or project is being assembled or disassembled. Discharge any high voltage points to ground with a well-insulated jumper.
- Remember that capacitors can store dangerous quantities of energy.
- Make measurements in live circuits with well-insulated probes and one hand behind your back. Do not allow any part of your body to contact any part of the circuit or equipment connected to the circuit.
- Never touch electrical equipment while standing on a damp or metal floor.
- Never handle wet, damp or ungrounded electrical equipment.
- Wearing a ring or watch can be hazardous in an electrical laboratory since such items make good electrodes for the human body.
- Never lunge for a falling part of a live circuit such as leads or measuring instruments.
- Never touch two pieces of equipment simultaneously.
- Never touch even one wire of a circuit; it may be “hot” (i.e. capable of delivering an electric shock).
- Avoid heat dissipating surfaces of high wattage resistors and loads as they may cause burns.
- Some components (particularly large wattage resistors) have exposed metal that is electrically “hot.” Take extra care when working with these components.
- Ask the Teaching Assistants or instructor to check your constructed circuit before applying power.
- Never short-circuit a power source.
- When using instruments connected to the power line, connect all ground leads to the same point. Otherwise, a short circuit may result.
- When using a voltmeter or ammeter, begin with the highest range and work your way down to a suitable range.
- When using an ohmmeter, never measure resistance in a live circuit.
- Keep instruments away from the edge of the work bench.
8. **A FEW GOOD GUIDELINES FOR YOUR INTERACTIONS WITH OTHERS IN CLASS**

- Respect others’ rights to hold opinions and beliefs that differ from your own.
- When you disagree, challenge or criticize the idea, not the person who spoke it.
- Listen carefully to what others are saying even when you disagree with what is being said. Comments that you make (asking for clarification, sharing critiques, expanding on a point, etc.) should reflect that you have paid attention to the speaker’s comments.
- Listen respectfully. Don’t interrupt or engage in private conversations while others are speaking. Use attentive, courteous body language.
- Support your statements. Use evidence and provide a rationale for your points.
- Share responsibility for including all voices in the discussion. If you have a lot to say, try to hold back a bit; if you are hesitant to speak, look for opportunities to contribute to the discussion.
- If you are offended by something or think someone else might be, speak up and don’t leave it for someone else to have to respond to it.
- Recognize that we are all still learning. Be willing to change your perspective, and make space for others to do the same.
- Don’t freeze people in time. Don’t use a past comment to categorize someone whose perspective may have changed.

9. **WHAT SHOULD WE BE GETTING OUT OF THIS CLASS?**

9.1 **THE COURSE OBJECTIVES**

a. Introduce important concepts in engineering  
b. Introduce the broad applications of engineering  
c. Introduce problem-solving strategies and the concept of engineering design  
d. Expose students to the broad principles of ethical decision making  
e. Investigate the ethical dilemmas that arise during the course of an engineer’s life  
f. Prepare students to produce written, oral and visual engineering communication  
g. Provide experiences in teamwork and team building  
h. Expose students to the range of stakeholders and interests affecting biotechnological development

9.2 **A FEW PERSONAL LEARNING OBJECTIVES THAT YOU MAY WISH TO TAKE AS YOUR OWN**

a. Commit to a common goal  
b. Become a pro-active learner  
   i. Explore resources  
   ii. Learn from every teammate  
   iii. Empower the team  
c. Facilitate productive teamwork  
d. Exploit failure for success  
e. Promote consensus v. agreement  
f. Stretch yourself – challenge your comfort zone daily  
g. Develop problem solving skills  
h. Develop essential college skills  
   i. Time management  
   ii. Study habits  
   iii. Test taking
10. **A MOSTLY TENTATIVE, MOSTLY ACCURATE SCHEDULE OF WHAT THIS CLASS WILL BE**

The tentative schedule for this course is as follows. However, given the happenstances of life and the twists of fate to which we are subjected, some of the specifics may change. Should that occur, your instructors will try their darnedest to let you know well beforehand.

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<th>Date</th>
<th>Topic</th>
<th>Due</th>
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<tr>
<td>15-May</td>
<td>An introduction to engineering</td>
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<td>17-May</td>
<td>Introduction to Technical Communication</td>
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<tr>
<td>22-May</td>
<td>&quot;Solving&quot; differential equations</td>
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<td>24-May</td>
<td>Audience; Writing a Proposal</td>
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<td>29-May</td>
<td>Actual circuits and why they work that way</td>
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<td>31-May</td>
<td>Writing the Heading, Foreword, and Summary</td>
<td>Homework I</td>
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<td>5-Jun</td>
<td>Electricity</td>
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<td>7-Jun</td>
<td>Writing the Project Proposal</td>
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<td>12-Jun</td>
<td>Creating Figures and Tables</td>
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<td>14-Jun</td>
<td>Project Part A</td>
<td>Project Demo 1</td>
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<td>19-Jun</td>
<td>Interfaces and materials</td>
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<td>21-Jun</td>
<td>Writing Experimental Procedures</td>
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<td>25-Jun</td>
<td>Writing the Findings and Conclusions</td>
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<td>26-Jun</td>
<td>Mechanics</td>
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<td>28-Jun</td>
<td>Technical Arguments</td>
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<td>2-Jul</td>
<td>An exercise with intellectual property</td>
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<td>3-Jul</td>
<td>Chemistry</td>
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<td>5-Jul</td>
<td>Presenting Technical Information</td>
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<td>9-Jul</td>
<td>Cohesion in Writing</td>
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<td>10-Jul</td>
<td>Sustainability</td>
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<td>12-Jul</td>
<td>Presentations</td>
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<td>16-Jul</td>
<td>A &quot;murder board&quot;</td>
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<td>17-Jul</td>
<td>Manufacturing</td>
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<td>19-Jul</td>
<td>Sentence and Idea Combining</td>
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<td>23-Jul</td>
<td>Peer Review of Progress Reports</td>
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<td>24-Jul</td>
<td>Infrastructure</td>
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<td>26-Jul</td>
<td>A writer's workshop</td>
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<td>31-Jul</td>
<td>Presentations</td>
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<td>2-Aug</td>
<td>Ethics in Engineering</td>
<td>Quizzes</td>
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<td>7-Aug</td>
<td>A philosophy of engineering</td>
<td>Participation</td>
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<tr>
<td>9-Aug</td>
<td>Design Expo; Project Part B</td>
<td>Project Demo 2</td>
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