

**Ve458 (Equivalent to UM EECS 458):
Biomedical Instrumentation and Design
(Fall 2017)**

Website: <https://umjicanvas.com>

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TA: Liliang Ren renll204@sjtu.edu.cn	Office hours: TBD or by appointment

Lecture: Monday 90 minutes (One hour required lecture and 30 minutes is reserved for possible additional lecture and office hour)

Laboratory: Two 3-hours on Monday/Wednesday (students can leave early once they complete the experiment and get approved from the TA)

Course Materials

- Required: Course notes, lab handouts, and associated documents (available by downloading from Canvas), lab notebook (individual)
- Text book: Medical Instrumentation: Application and Design, J.G. Webster (Ed.), 4th edition. John Wiley & Sons. (not required, only for reference)

Grading Criteria

Homework + in-class Quizzes (individual)	10%
Pre-lab Problem Sets (individual)	10%
Lab Notebook (individual)	15%
Lab Reports (group)	20%
Lab Performance (individual)	15%
Lab Practical (individual)	Pass/Fail
Lab Design Project (group/individual)	30%
(TBD) Bonus: NI LabVIEW CLAD Test (individual)	5%

The letter grade associated with the median score is expected to be in the range of 'A-' to 'B+'
More details on grading criteria for each item are described on page 3.

Lecture and Lab Topics

Week	Lecture Topic	Lab Project
1	Overview of Biomedical Instrumentation, instruments and LabVIEW basics, circuit basics	A-Intro lab
2	Op Amps and filters, A/D conversion, LabVIEW	A-Intro lab
3	Introduction to EMG	B-EMG
4	National Holiday Break	
5	More on EMG, Biopotential, Electrodes, Signal Analysis	B-EMG
6	Introduction to EMG-based communication system lab	C-EMG-based communication system lab
7	Introduction to ECG, surface electrodes, electronics interface for ECG recording system	D-ECG
8	Pulse Oximetry	E-Pulse Oximetry
9	Pulse Oximetry	E-Pulse Oximetry
10	Student Design Project Proposal Presentations	Design Project
11	Student Design Project Proposal Presentations	Design Project
12	Student Design Project Proposal Presentations	Design Project
13/14	Design Project Examination	Design Project Examination

Lab Project Description

- *A: Introductory lab* – Introduction to lab instruments, electronic circuits, programming, testing, data acquisition, and lab safety.
- *B: EMG lab* – Develop an EMG measurement system.
- *C: EMG-based Communication system lab* – Develop a system for real-time communication using voluntary EMG
- *D: ECG lab* -- Develop an ECG measurement system
- *E: Pulse Oximetry lab* -- Develop a system for pulse oximetry using optical measurements
- *Design project* -- Develop a prototype instrumentation system that demonstrates proof-of-concept of a biomedical instrument that is selected by the lab group. The project deliverables include design documents, a lab demonstration, an in-class presentation, and a final project report. Each group needs to submit their design proposal to the instructor by week 6. The proposal should be 1 page long presenting the ideas, project design and a part list. The part list should contain the name, price and quantity of the parts you need and where to order them, so that the appropriate parts can be ordered ahead of time. The budget for each design project is 500 RMB per group. The proposal needs to be approved by the instructor and TA by week 7. If your group has justifiable reasons to change or improve the design after week 7, discuss it with the instructor or your TA. The part list cannot be changed after week 7.
- General introduction and guidelines for each lab project will be given in the lecture. The TA will also give a brief overview of the lab at the first lab session of each project. Lab project handouts will be posted on canvas prior to the lab.

Homework + in-class Quizzes (10%)

There will be 1-2 homework sets and 1-2 in-class quizzes.

Lab Groups

The lab projects are performed in groups, with each group consisting of 3-4 people. The lab group will be assigned by TA at the first intro lab session and finalized at the end of the intro lab session. For each lab project, there will be 1-2 hardware engineer(s) (breadboard circuit), 1-2 software engineer(s) (LabVIEW), and 1 system engineer (project design) in the group. You should take one role for each lab and rotate through different roles throughout the semester. By the end of the semester, you should have taken all three roles. Otherwise, points will be deducted from your grade.

Pre-lab Problem Sets (10%, 2% for each lab)

Pre-lab problem sets will be given in the lab handouts prior to each lab. Read the handouts and answer the pre-lab questions on your lab notebook before the lab. For the intro lab, the LabVIEW tutorial assignment is due by week 2. You are encouraged to turn in your pre-lab solution for the first two circuits by week 2. All four pre-lab circuits are due by week 3. For the other labs, answer your pre-lab questions and turn them in to the TA at the first session of each lab project. The TA will grade them and give you back the lab notebook at the same lab session or the session after that. The pre-lab problem sets should be answered by yourself without consulting other students.

Individual Lab Notebook (15%, 3% for each lab)

Each student should have a bounded lab notebook with a table of content labeled. The lab notebook will be graded by the TA after completion of each lab project based on correctness and completeness. You only need to record the notes related to your main responsibility (e.g., software/hardware/system engineer). Your TA will give you more specific instructions on notebook guidelines in the lab.

Group Lab Reports (20%, 4% for each lab)

At the end of each lab, each group turns in one lab report to the TA. The lab report should be a summary of the lab and discussion on the issues following the instruction in the handout. The lab report will be graded as the group, i.e., your lab mates and you will receive the same score for the lab report. You should participate in preparation for each lab report and are required to write at least one report. Each lab report should be limited to 2-4 pages. Don't use extra small font to cram in more stuff. Learn to be concise and emphasize on all key points. For EMG communication system lab, the lab report is not required. Your group lab report score will be based on the number of words successfully communicated per minute.

Individual Lab Performance (15%, 3% for each lab)

Your performance (i.e.: attendance, lab activity, etc.) in each lab will be observed and evaluated by the TA (3% for each lab). This evaluation will reflect in your final grades and not given to you in each lab.

Individual Lab Practical (Pass/Fail)

Lab practical is designed to evaluate the basic skills required for this course (e.g., construct a breadboard circuits and build LabVIEW VI). The lab practical handout will be posted on Canvas Resources. Complete the lab practical yourself without help from others. You are encouraged to complete your lab practical test as early as the end of the intro lab (week 2). You can take the lab practical as many times as you want to, but you have to pass it no later than (week 5) in order to continue the class. If you take your lab practical early and pass it, you will get 1 bonus point. Your lab practical test results will be taken into account in your lab performance score.

Group Lab Design Project (30%)

Each group is required to develop a prototype instrumentation system that demonstrates proof-of-concept of a biomedical instrument that is selected by the lab group. Each student will be graded by group design implantation score \times individual effort percentage. The score for the group design implementation (100 points) will be based on your proposal presentation and the implementation of the project. Your group will give student design project presentations in the lecture session Weeks 12-13. The schedule will be determined and you will be notified by Week 9. The implementation of the project will be evaluated in the lab sessions in weeks 12-13. The score will be given by peer-reviews (other groups, 20 points), your TA (30 points), and the instructor (50 points). The effort percentage refers to the effort of each student taken on the design project and will be evaluated by your lab mates (50%) and you TA (50%)

Canvas course website

Refer to the Canvas course website (Ve458 F17) for all course information. Lab handouts, lecture slides, syllabus, and reading material will be uploaded to Canvas Files. You are required to take a picture of your lab set up including the breadboard circuit and LabVIEW VI for each lab and the final design project.