

BME/EECS 458: Biomedical Instrumentation and Design

Instructors, Office Hours, General Information

Instructors

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GSI^s

Nathan Lawera (Sections 2 & 4)
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Hannah Soifer (Sections 3 & 5)
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Office hours:

Fan:	Mo	5:00p – 6:00p	(2158 LBME)
Clafin:	Mo	5:00p – 6:00p	(2232 LBME)
Nathan:	Tu	12:30p – 2:30p	(1105 LBME)
Hannah:	Tu	5:30p – 6:30p	(1105 LBME)
	We	5:30p – 6:30p	(1105 LBME)

Lecture: Mon, 4:00 – 6:00p, 1013 Dow
(typical lecture is from 4 – 5p with 5 – 6p reserved for additional lecture or office hours)

Lab:

Sec 2:	Tu, Th	2:30p – 5:30p	1105 LBME	(Nathan)
Sec 3:	Tu, Th	6:30p – 9:30p	1105 LBME	(Hannah)
Sec 4:	Tu, Th	9:30a – 12:30p	1105 LBME	(Nathan)
Sec 5:	Mo, We	6:30p – 9:30p	1105 LBME	(Hannah)

Course Materials

- Required: Lab notebook (192-page version). Notebooks are sold during first lab period (\$20, cash or check made out to Biomedical Engineering Society).
- Optional: *Medical Instrumentation: Application and Design*, J. G. Webster (Ed.), 4th edition. John Wiley & Sons. (not required, available in the library)

Attendance Policy

Students are expected to attend *all* sessions of the laboratory. A student choosing to miss a lab session to attend another commitment (*e.g.*, job interviews, graduate school interviews) must inform the GSI in advance and make a compensating contribution to the group effort (*e.g.*, by performing offline analyses, taking the lead on the writing of the lab report, etc.). Illness and family emergencies will be handled on an individual basis. Contact the GSI as soon as possible if an emergency arises.

Lab Groups

The lab projects are performed in groups of 3-4 students. Lab groups will be assigned by GSIs before the beginning of Module 2 (Introductory Lab). Students will not be allowed to choose their group-mates, but instead will be assigned to groups with the goal of balancing expertise; each group will have at least one member with LabVIEW experience and one with circuit experience (based on student responses to a questionnaire). For each lab module, each group will designate 1-2 hardware engineer(s) (breadboard circuit) and 1-2 software engineer(s) (LabVIEW). Each group member should alternate between hardware and software roles throughout the semester.

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Canvas course website

Refer to the [Canvas](#) course website for all course information and materials including assignments, lab handouts, lecture slides, grades, etc. Course communication will be via Canvas “Announcements”. Most assignments are submitted via upload to Canvas (pdf format).

Canvas Calendar

Your Canvas calendar (accessed via a link in the far-left column of the [Canvas](#) user interface) provides a comprehensive view of lecture times, lab times & topics, and all assignment due-dates. Calendar entries are *section-specific* – you will only see events and due-dates that apply to your section. Our goal is to have all date- & time-critical information available in one place for your convenience – feedback is welcome and appreciated!

Important Dates

The items listed below are on your Canvas calendar, but are repeated here for emphasis:

	<u>Date</u>	<u>Event</u>
September	4	Lab Orientation
	5	Lab Orientation
	10	First lecture
	24	Homework 1 due
October	1	Homework 2 due
	11	Lab Practical deadline
	15 & 16	Fall Study Break (no lecture, labs)
	29	Design Project proposals due
November	5	Design Project proposals, parts lists & presentation schedules finalized
	12	Design Project proposal oral presentations (Sections 2 & 4: 1200 EECS; Sections 3 & 5: 1013 Dow)
	21	Section 5 only: Lab will be open from 9:00a – 5:00p (No evening lab!)
	22 & 23	Thanksgiving Break (no labs)
December	10	Design Project final oral presentations (final meeting of class) (Sections 2 & 4: 1200 EECS; Sections 3 & 5: 1013 Dow)

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Lecture Topics, Lab Modules

Lecture Topics: The following topics will be covered during the Monday lectures: overview of biomedical instrumentation, instrumentation basics, circuit basics, operational amplifiers, active filters, analog-digital conversion, sampling, signal processing, spirometry, electrocardiography (ECG), pulse-oximetry.

Lab Modules: Project topics and number of 3-hour lab periods devoted to each:

<u>Project Topic</u>	<u>Number of lab periods</u>
1. Module 1: LabVIEW	1
2. Module 2: Introductory Lab.....	5
3. Module 3: Spirometry.....	4
4. Module 4: ECG	4
5. Module 5: Pulse-Oximetry	4
6. Module 6: Design Project	7

Lab Module Descriptions:

General introduction and guidelines for each lab module will be given in lecture. The GSI will also give a brief overview of the expectations during the first lab session of each module. Lab module handouts will be posted on Canvas.

Module 1: LabVIEW – Tutorial to introduce the LabVIEW graphical programming environment and “virtual instruments”. Tutorial concludes with data acquisition using A-D hardware.

Module 2: Introductory Lab – Introduction to lab instruments, electronic circuits, programming, testing, data acquisition, and signal processing theory.

Module 3: Spirometry – Develop a spirometry system to measure respiratory flow rates.

Module 4: ECG – Develop an electrocardiography (ECG) system to acquire, analyze, and display 3-lead electrocardiograms.

Module 5: Pulse-Oximetry – Develop a system for determining the saturation level of hemoglobin in arterial blood using optical measurements.

Module 6: Design Project – Develop a prototype instrumentation system that demonstrates proof-of-concept of a biomedical instrument that is selected by the lab group. Project deliverables include design proposal documents, a lab demonstration, an in-class presentation, and a final project report.

Graded Assignments: Weighting by category, Descriptions

<u>Assignments</u>	<u>Weights</u>
Lab Practical (individual)	Pass/Fail
Homework (individual)	10 pts (10%)
Lab Notebook and Performance (individual)	40 pts (40%)
Lab Reports (group)	20 pts (20%)
Lab Design Project (group/individual)	29 pts (29%)
Course Evaluation (bonus point)	1 pt (1%)
Total:	100 pts (100%)

Final letter grade associated with the median score is expected to be in the range of “A-” to “B+”. (Additional details on grading criteria for each assignment category are given below.)

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Lab Practical: Pass/Fail

The Lab practical is designed to evaluate the basic skills required for this course (construct breadboard circuits, build LabVIEW VI, etc.). Complete the Lab Practical yourself without help from others. You are encouraged to complete your Lab Practical as early as the end of the Introductory Lab module. *You will be limited to 4 attempts, and must pass by the due date specified in the Lab Practical Canvas "Assignment" in order to continue the class.*

Homework: 10 pts (2 sets, 5 pts for each set)

There will be two homework sets. Topics include circuit basics, LabVIEW, and signal processing theory, all covered during the first three weeks. *Homework due dates and times are specified in the corresponding Canvas "Assignment".*

Individual Lab Notebook and Lab Performance: 40 pts (10 pts each for Introductory Lab, Spirometry, ECG, and Pulse-Oximetry modules)

Lab notebooks will be graded by the GSI after completion of each lab module based on correctness and completeness. You only need to record the notes related to your main responsibility (*i.e.*, software/hardware). In addition to the Lab Notebook, your performance in lab will be evaluated by the GSI and your group peers for each lab module. *Due dates & links to a document containing lab notebook guidelines, performance expectations and details of the grading breakdown can be found within the corresponding Canvas "Assignments".*

Group Lab Reports: 20 pts (5 pts each for Introductory Lab, Spirometry, ECG, Pulse-Oximetry)

At the end of each lab module, each group turns in one lab report (upload PDF to Canvas + hardcopy to GSI). The lab report should be a summary of the lab module and discussion of the issues following the instructions in the handout. The lab report will be graded by group, *i.e.*, you and your group-mates will receive the same score for the lab report. All group members should participate in preparation of each lab report and each group member is required to write at least one report. The lab report for Module 2 (Introductory lab) has a 7-page limit (including figures). All remaining lab reports are limited to 4 pages (including figures). Lab reports are due one week after the completion of the corresponding lab module. Points will be deducted for exceeding page limits. Use 11 pt font and 0.75-inch margins. Be concise and emphasize all key points.

Group Final Design Project: 29 pts

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 group will give a 10-minute proposal presentation during the lecture period on **November 13 (Monday)**. The schedule will be determined and notified by **November 6**. The lab demo of the project will be evaluated during the lab periods on **December 6 and 7** (your last lab session) and the final project presentations will be given on **December 11 (Monday)**. The 29 pts will be distributed as follows:

	GSI	Instructor	Peers
Final oral presentation	5 pts	5 pts	-
Final lab demo	5 pts	5 pts	-
Final report	4 pts	-	-
Final notebook	1 pt	-	-
Individual effort	2 pts	-	2 pts

Course Evaluation: 1 pt (awarded for submitting confirmation screenshot by deadline)