ASU Ira A. Fulton Schools of
Engineering
Arizona State University

BME 210: Programming for Biomedical Engineers

Course description: Computers are ubiquitous tools in all engineering disciplines. Biomedical engineering pushes the limits of computational power in all applications--from small computers embedded in medical devices to large computer clusters used in research projects. Understanding the fundamental operation of computers and how to program them efficiently and effectively is a crucial skill for biomedical engineers. This course will cover the fundamentals of computer architecture, functioning, and programming. Students will learn to program using Python and develop the skills to use programming for problem-solving and product development in their careers as biomedical engineers.

Prerequisite(s): Biomedical Engineering BSE major; MAT 265 or 270 with C or better; Pre- or corequisite(s): BME 122 with C or better if completed; MAT 266 or 271 with C or better if completed OR Visiting University Student.
Lecture schedule: Mon, Wed, Fri from 1:30 – 2:45 PM (8/19 – 12/2)
Lecture hall: Hayden Library LIBL50

Instructor
Dr. Christopher Plaisier
Phone: 480-965-6832
E-mail: plaisier@asu.edu
Office Hours: Wednesday and Friday from 11:45 AM - 1:15 PM on Zoom at https://asu.zoom.us/my/cplaisier. All meetings will be by Zoom unless otherwise specified, because sharing screens is extremely helpful for programming and debugging. Appointments outside of office hours can be set up by email.

Canvas: https://asu.instructure.com/courses/126430

Textbooks and other requirements
No textbook is assigned for this course. All materials for the course will be made available on Canvas or through links to other resources.

Computer requirement
A computer with a functional Python programming environment is required for this course. Support to install the Python programming environment will be given over the first two weeks of the course. Please contact the instructor if there are any issues meeting the computer requirement. Students are responsible for ensuring they have their computer with them in class.

Course objectives and student learning outcomes
This course aims to provide students a foundational knowledge of programming. What a programming language is and how to learn to use one by learning to use Python. Students will learn:
- How to define the components of a computer and their function
- How to program in Python: syntax, data representations, programming structures, functions, modules, testing, and running programs
- Use programming to conduct statistical tests: correlation, linear regression, Student's T-test
- Use programming to conduct biomedical data analysis: analyze electrocardiogram signals, data integration, and design of experiments (DOE)

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Course point distributions
- Participation   -   20%
- Homework   -   30%
- Exams (3 midterms + final)   -   50%

Grading (%)

A+	97 – 100		B-	80 – 82
A	93 – 96		C+	77 – 79
A-	90 – 92		C	73 – 76
B+	87 – 89		D	60 – 72
B	83 – 86		E	Below 59

Participation
This class will involve hands-on learning in the form of programming tasks and assignments. Each student will be asked to turn in code file(s), result(s), or answer quizzes based on hands-on learning activities.

Homework
Students will be given homework that requires them to practice their programming skills. The goal of this homework is to highlight and reinforce essential concepts.

Exams
The midterm and final exams will be based on material and concepts from lectures and will include programming tasks. Each exam will primarily cover new material since the last exam. Exams may be conducted online in the Respondus LockDown browser and are expected to be completed during the normal course time. Students are expected to have reviewed the notes on using the LockDown browser and have the browser open and navigated to the Canvas exam page before the start of the exam.

Make-up exam
Make-up exams will be available if a student misses an exam due to a medical or personal emergency which is documented by doctor's note, police report, funeral director note, religious observances/practices that are in accord with ACD 304–04, "Accommodation for Religious Practices," or excused absences related to university-sanctioned events/activities that are in accordance with ACD 304–02, "Missed Classes Due to University-Sanctioned Activities". Excused absences related to missed class due to military line-of-duty activities that are in accord with ACD 304–11, "Missed Class Due to Military Line-of-Duty Activities," and SSM 201–18, "Accommodating Active Duty Military". Documentation has to be presented to the instructor and he has discretion as to what constitutes an emergency requiring a make-up exam.

Grade disputes and/or questions
All grading questions should be directed to the instructor. In all cases, questions and concerns about grades or grading procedures must be filed within one week of grades being posted.

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Lecture schedule

Month	Week	Day	Weekday	Topic	Overarching topic
August	1	19	F	The computer	Computers
	2	22	M	Thinking in binary	
		24	W	How computers work/file systems	
		26	F	Text editor/console/command prompt	
	3	29	M	Hardware/software/programming languages	Programming
		31	W	Python: Hello World!	Python
September		2	F	Python syntax	
	4	5	M	Labor day (no class)	
		7	W	Debugging/testing/error messages/getting help	Debugging
		9	F	Midterm 1	
	5	12	M	Variables / operators	Python data representations
		14	W	List, dictionary	
		16	F	Set, tuple	
	6	19	M	AWYL: Nesting data types	
		21	W	Conditional statements/branching logic	Programming structure
		23	F	AWYL: Decision tree	
	7	26	M	For loop	
		28	W	While loop	
		30	F	AWYL: Looping	
October	8	3	M	Functions	Functions
		5	W	AWYL: Making your own functions	
		7	F	Midterm 2	
	9	10	M	Fall break (no class)	
		12	W	JSON module	JSON
		14	F	AWYL: Writing and reading JSON	
	10	17	M	Modules	Modules
		19	W	AWYL: Making your own module	
		21	F	Loading files	Correlation (hard way)
	11	24	M	matplolib: scatterplot/line plot	
		26	W	AWYL: correlation the hard way	
		28	F	Pandas: read.csv/basics/scipy.stats	Correlation (easy way)
	12	31	M	AWYL: Correlation parametric vs. nonparametric	
November		2	W	seaborn: boxplot/swarmplot/violinplot	
		4	F	scipy.stats: T-test/statsmodels.multitest	T-test
	13	7	M	AWYL: Transcriptomics data analysis	
		9	W	Midterm 3	
		11	F	Veterans day (no class)	
	14	14	M	Intro: ECG example	Signal processing example
		16	W	AWYL: ECG day 1	
		18	F	AWYL: ECG day 2	
	15	21	M	Intro: Data integration	Data integration example
		23	W	AWYL: Data integration	
		25	F	Thanksgiving (no class)	
	16	28	M	Intro: DOE	Design of experiment example
December		30	W	AWYL: DOE day 1	
		2	F	AWYL: DOE day 2	
	Final week	5	M	Final exam (2:30 - 4:20 PM)	

Canvas

This course will extensively use Canvas for communicating course information, discussions, and communicating with instructors. Canvas can function both as a course website and as an interactive forum. Please access Canvas at http://my.asu.edu. You are responsible for any materials or information posted on the site. All students pre-registered for the course have been enrolled and have been sent emails to their ASU email accounts. If you have not received an email, check to make sure that BME 210 shows up on your Canvas listing. E-mails from Canvas can only be sent to your ASU e-mail; if you regularly use a different e-mail account please set up your ASU email to forward to the account you check most regularly.

Please login to Canvas regularly to view Announcements for the course. The syllabus is posted under Course Information. You will be able to download lecture outlines and related information under Course Materials and to ask and answer questions in the Discussion boards. Your lecture grades throughout the semester will also be posted on Canvas; however, at any given time they may not reflect your updated scores. Be aware of this when checking your grades.

LockDown browser + webcam requirement

This course requires the use of LockDown Browser and a webcam for online exams. The webcam can be the type that's built into your computer or one that plugs in with a USB cable. Watch this brief video to get a basic understanding of LockDown Browser and the webcam feature.
https://www.respondus.com/products/lockdown-browser/student-movie.shtml

Download instructions
Download and install LockDown Browser from this link:
https://download.respondus.com/lockdown/download.php?id=197112001

Once installed
- Start LockDown Browser
- Log in to Canvas
- Navigate to the Exam/Quiz

Note: You won't be able to access a quiz that requires LockDown Browser with a standard web browser. If this is tried, an error message will indicate that the test requires the use of LockDown Browser. Simply start LockDown Browser and navigate back to the exam to continue.

Guidelines
Follow these guidelines when taking an online exam:
- Ensure you're in a location where you won't be interrupted
- Turn off all other devices (e.g. tablets, phones, second computers) and place them outside of your reach
- Before starting the test, know how much time is available for it, and also that you've allotted sufficient time to complete it
- Clear your desk or workspace of all external materials not permitted - books, papers, other devices
- Remain at your computer for the duration of the test
- If the computer, Wi-Fi, or location is different than what was used previously with the "Webcam Check" and "System & Network Check" in LockDown Browser, run the checks again before the exam

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- To produce a good webcam video, do the following:
  - Avoid wearing baseball caps or hats with brims
  - Ensure your computer or device is on a firm surface (a desk or table). Do NOT have the computer on your lap, a bed, or other surfaces where the device (or you) are likely to move
  - If using a built-in webcam, avoid readjusting the tilt of the screen after the webcam setup is complete
  - Take the exam in a well-lit room, but avoid backlighting (such as sitting with your back to a window)
- Remember that LockDown Browser will prevent you from accessing other websites or applications; you will be unable to exit the test until all questions are completed and submitted

Getting help
Several resources are available if you encounter problems with LockDown Browser:
- The Windows and Mac versions of LockDown Browser have a "Help Center" button located on the toolbar. Use the "System & Network Check" to troubleshoot issues. If an exam requires you to use a webcam, also run the "Webcam Check" from this area
- Respondus has a Knowledge Base available from support.respondus.com. Select the "Knowledge Base" link and then select "Respondus LockDown Browser" as the product. If your problem is with a webcam, select "Respondus Monitor" as your product
- If you're still unable to resolve a technical issue with LockDown Browser, go to support.respondus.com and select "Submit a Ticket". Provide detailed information about your problem and what steps you took to resolve it

Code of conduct for academic integrity
All students in this class are subject to ASU's Academic Integrity Policy (available at http://provost.asu.edu/academicintegrity) and should acquaint themselves with its content and requirements, including a strict prohibition against plagiarism. All violations will be reported to the Dean's office, who maintain records of all offenses. Students are expected to abide by the FSE Honor Code (http://engineering.asu.edu/integrity/). Be especially aware that all assignments and exams are to be your own work unless you are explicitly permitted to hand in work as a team. Students are encouraged to discuss the primary literature read during the course with other students. Homework questions may also be discussed, but questions should be answered independently by each student in their own words. At the professor's discretion, student writing may be tested for plagiarism using online tools.

Classroom behavior
Courteous classroom behavior is expected during both the lecture and lab. All communication devices (cell phones, pagers, etc.) are expected to be turned off or silenced. Computers are allowed so long as they do not distract others.

The CDC recommends staying up to date with vaccines and wearing masks indoors in public areas when there is high community spread. The CDC provides a website to check the level of community spread (ASU is located in Maricopa County, Arizona): https://www.cdc.gov/coronavirus/2019-ncov/your-health/covid-by-county.html Please stay at home and get tested if you have symptoms using Devils' drop-off: https://devilsdropoff.asu.edu/

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If isolating or quarantining please contact the instructor to make accommodations such as Zoom access to lectures, supplementary materials or assignments, etc.

Student absence policy
Attendance and participation in class activities is an essential part of the learning process, and students are expected to attend class regularly. Some absences are, however, unavoidable. Excused absences for classes will be given without penalty to the grade in the case of (1) a university-sanctioned event [ACD 304-02]; (2) religious holidays [ACD 304-04; a list can be found here https://eoss.asu.edu/cora/holidays]; (3) work performed in the line-of-duty according [SSM 201-18]; and (4) illness, quarantine or self-isolation related to illness as documented by a health professional.

Anticipated absences for university-sanctioned events, religious holidays, or line-of-duty activity should be communicated to the instructor by email at least 24 hours before the expected absence.

Absences for illness, quarantine or self-isolation related to illness should be documented by a health professional and communicated to the instructor as soon as possible by e-mail.

Excused absences do not relieve students from responsibility for any part of the course work required during the period of absence. The instructor will provide accommodations that may include participation in classes remotely, access to recordings of class activities, and make-up work.

If there is a disagreement as to whether an absence should be accommodated, the instructor and student should contact the academic unit chair immediately for resolution.

Copyright
All course content and materials, including lectures (Zoom recorded lectures included), are copyrighted materials and students may not share outside the class, upload to online websites not approved by the instructor, sell, or distribute course content or notes taken during the conduct of the course (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5-308 F.14 for more information).

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Policy against threatening behavior
No threatening behavior will be tolerated pursuant to ASU policy. See SSM 104–02: Handling Disruptive, Threatening, or Violent Individuals on Campus (https://www.asu.edu/aad/manuals/ssm/ssm104-02.html). Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services. Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

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Disability accommodations
Suitable accommodations will be made for students having disabilities and students should notify the instructor as early as possible if they will require the same. Such students must be registered with the Disability Resource Center and provide documentation to that effect. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities.

Instructor absence policy
In the event the instructor fails to indicate a time obligation, the time obligation will be 15 minutes for class sessions lasting 90 minutes or less, and 30 minutes for class sessions lasting more than 90 minutes. Students may be directed to wait longer by someone from the academic unit if they know the instructor will arrive shortly.

Harassment and sexual discrimination
Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed based on sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling is available if you wish to discuss any concerns confidentially and privately. ASU online students may access 360 Life Services, https://goto.asuonline.asu.edu/success/online-resources.html.

Syllabus changes
Any information in this syllabus (other than grading and absence policies) may be subject to change with reasonable advance notice.