

# **Table of Contents**

***BME 4803 (Biomedical Data Science) | 6313 (Computational Bioengineering and Biomedicine)* ..... 2**

**Course Information.....2**

**Learning Goals.....2**

**Course Materials .....2**

**Activities and Grading.....2**

**Essential Student Information .....4**

**Instructor Contact Information .....5**

**Communication Plan .....5**

**Assessments and Assignments .....6**

**Course Schedule.....6**

**Course Management and Policies.....6**

**Instructor-Initiated Drops.....8**

**Student Code of Conduct and Scholastic Dishonesty .....8**

# BME 4803: Biomedical Data Science / BME 6313: Computational Bioengineering and Biomedicine

Spring 2023

## COURSE INFORMATION

---

**Course Description:** This course aims to provide students with the ability to use computational methods to understand and analyze biological data. Topics covered include high-throughput biomedical data analysis, modeling of signaling pathways, network analysis, image analysis, and artificial intelligence methods.

**Credit hours: 3**

**Prerequisites/co-requisites:** Engineering Analysis I or equivalent

**Course Modality:** This course is fully online in a hybrid format. While select content for this course will be delivered asynchronously, there are required synchronous meetings that are part of your final grade. These required online sessions will occur on Tuesdays from 8:00-9:30 am CT unless noted in the course syllabus.

## LEARNING GOALS

---

**Overall Goal:** This course will introduce students to advances in computational biology from an engineering perspective, and equip them with a suite of tools emerging from systems biology.

**Specific Objective I:** To be able to choose the most appropriate quantitative tools (e.g., modeling method, quantitative image-analysis) to assess a biological system of interest.

**Specific Objective II:** To gain the skills needed to interpret large, complex, multimodal data (images, public health data, epigenomic screens, protein-DNA interaction data, etc.) and be knowledgeable of the ways to characterize their interrelationships and dynamics.

**Specific Objective III:** To gain familiarity with the methods, platforms, languages, and databases available in the quantitative systems biology field that have broad applications in bioengineering.

## COURSE MATERIALS

---

Required course readings will be found on the course website ([qutublab.org/compbio](http://qutublab.org/compbio)). There are no required textbooks. Recommended textbooks for more in-depth discussions of course material include:

Geron A. (2019) “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems”, O’Reilly Press. **Relevancy:** Practice on applications of methods and modeling introduced in class.

Alon U. (2006) “An Introduction to Systems Biology: Design Principles of Biological Circuits,” Chapman & Hall/CRC Press. **Relevancy:** Describes the concept of biological motifs (common circuit architectures), and how they can offer insight into molecular signaling dynamics.

Gershenfeld N. (1999) “The Nature of Mathematical Modeling,” Cambridge Univ. Press. **Relevancy:** Describes multiple modeling methods, including cellular automaton and stochastic modeling.

### ACTIVITIES AND GRADING

Modeling Project	40%
Course Participation	
• Modeling Challenge I	10%
• Modeling Challenge II	10%
• Modeling Challenge III	30%
• Modeling Challenge IV	10%
Total	100%

### Grade Distribution and Letter Grade

#### Grading Scale

Final grades will be based on the following grading scale:

Percentage	Grade
100%	A+
93 – 99%	A
90 – 92%	A-
87 – 89%	B+
83 – 86%	B
80 – 82%	B-
77 – 79%	C+
73 – 76%	C
70 – 72%	C-
67 – 69%	D+
63 – 66%	D
60 – 62%	D-
<60%	F

TABLE 1. A BREAKDOWN OF LETTER GRADES BY PERCENTAGE EARNED.

### ASSIGNMENTS & ASSESSMENTS

This class will contain lectures, modeling challenges and a modeling project. Readings from peer-reviewed articles will complement material covered in class.

**Modeling Challenges:** Modeling challenges are due at the beginning of class and count towards class participation. Students are encouraged to work in groups on assignments, however each student must complete the material and handle in / present independent copies of their assignment.

**Course Participation:** Course participation includes completing modeling challenges, asking questions in class, contributing to in-class discussions and challenges and/or discussions with the instructor outside of class. Peer evaluation on the semester-long modeling project (e.g., your contribution) will also count towards your participation grade.

**Modeling Project:** Reports and code are due at the beginning of class, as indicated on the schedule. Peer evaluation on the modeling project (e.g., class peer score, contribution score by your project teammates) will contribute to your overall project grade. A final project report is due on **May 10**.

**Final Exam:** No final exam. Modeling Challenges will cover course material.

NOTES: If you believe that a mistake has been made in grading, you have ONE WEEK to request a regrade in writing.

## **ESSENTIAL STUDENT INFORMATION**

---

- **Important:** Bookmark and visit the [Common Syllabus Information webpage](#) to find important and valuable resources about counseling services, transitory/minor medical issues, supplemental instruction, tutoring services, academic success coaching, sexual harassment and sexual misconduct, campus safety and emergency preparedness, inclusivity statement, and the Roadrunner Creed.
- For technical requirements, support, and academic resources, visit the [Student Support Gateway](#), where you can find all your tech and academic support resources in one place.
- Follow [Online Learning Netiquette](#) standards for your online communication activities. Please be mindful of the communication tools available in your course and use them for learning purposes. Class discussions take place in a respectful and safe environment, whether online or in person. UTSA encourages everyone to openly share their ideas and opinions without penalty or judgment, but learning should always be based on facts and research. It is possible to disagree without being disagreeable.
- UTSA provides reasonable accommodations to students via the [Student Disability Services](#). For more details on eligibility, policies, and requirements, please visit [www.utsa.edu/disability](http://www.utsa.edu/disability) or call (210) 458-4157.
- **UTSA Wellbeing Resources:** your wellbeing is a priority for us. UTSA is proud to partner with [Wellness 360](#) and [MySSP](#) to provide students with access to

quality health and mental health care. Visit the [UTSA Students Wellbeing Resources](#) to explore the services available.

## **INSTRUCTOR CONTACT INFORMATION**

---

**Instructor Name:** Amina Qutub, Pronouns: She/Her/Hers

**Department and College:** Biomedical Engineering, College of Engineering and Integrated Design

**Office and student hours:** Tuesday, 9:30-10:30 am online each week, unless otherwise noted.

***Office Hours & Contact:***

Online office hours, by email appointment ([amina.qutub@utsa.edu](mailto:amina.qutub@utsa.edu)) and/or directly after Tuesday's class, 9:30-10:30 am each week. Students are welcome to come with individual questions to the student hours. Class project teams also are welcome to set up regular times to meet online during the semester for guidance on their project.

**Email Address:** [amina.qutub@utsa.edu](mailto:amina.qutub@utsa.edu)

## **COMMUNICATION PLAN**

---

There are several ways you can communicate with the instructor during this online course:

1. Email the instructor directly at [amina.qutub@utsa.edu](mailto:amina.qutub@utsa.edu) from your own email account. Keep in mind, however, that the instructor cannot communicate about grades through email. The instructor will generally respond to messages within 24 hours.
2. Connect during Zoom office hours.
3. Use the "Course Messages" tool to send a private message about grades. This communication stays in Blackboard and is the only secure way to discuss your grade. You will have to log in to Blackboard to send and receive these course messages.

### **About Me**

Students are welcome to call me Dr. Q or Dr. Qutub (or Amina), and I use the pronouns she/her/hers. I have been teaching for 15 years and have been at UTSA since 2018.

I earned my undergraduate degree (B.S., chemical engineering) from Rice University in Houston, TX; my doctorate in bioengineering with a minor in mathematical modeling and neuroscience from University of California, Berkeley and UCSF, CA; and my postdoc fellowship in biomedical engineering from The Johns Hopkins University in Baltimore, MD. I am a native of the U.S. Midwest, who grew up in New Jersey, Maryland and Illinois. I love to use coding and modeling to make an impact on human health – and this enthusiasm I hope to share during the semester. I am delighted to be part of your academic journey.

## My Teaching Philosophy

After years of teaching and being a student myself, I strongly believe that in biomedical data science, students learn best by working on challenging, real-world projects that help them think through multiple solutions and decisions – and help prepare them for their future careers. I emphasize creative, solution-driven problems rather than traditional exams and quizzes. I also encourage meeting as teams and/or regularly coming to Student Hours, to discuss class materials and/or outside projects relevant to the class topics (e.g., students have helped launch commercial technologies from what they learned in my classes).

## My Inclusivity Statement

The University of Texas at San Antonio, a Hispanic Serving Institution situated in a global city that has been a crossroads of peoples and cultures for centuries, values diversity and inclusion in all aspects of university life. As an institution expressly founded to advance the education of Mexican Americans and other underserved communities, our university is committed to ending generations of discrimination and inequity. UTSA, a premier public research university, fosters academic excellence through a community of dialogue, discovery, and innovation that embraces the uniqueness of each voice.

Diversity (& outliers) in backgrounds and opinions help drive innovation in data science and biomedicine, and this philosophy guides my approach to fostering inclusive excellence and encouraging class dialogue.

## ASSESSMENTS AND ASSIGNMENTS

Modeling Project	40%
Course Participation	
• Modeling Challenge I	10%
• Modeling Challenge II	10%
• Modeling Challenge III	30%
• Modeling Challenge IV	10%
Total	100%

## COURSE SCHEDULE

<i>Introduction to Computational Bioengineering</i>		
Date	Week's Lecture Topic	HW & Notes
1/17	Course Overview	
1/24	Introduction to Computational Bioengineering Methods	Complete Class Survey

1/31	Recognizing Patterns in Biology	
2/7	Handling High-Dimensional Biomedical Data	Modeling Challenge I due (2/7)
2/14	Classification & Clustering	
2/21	Decision Trees & Random Forest	Modeling Challenge II due (2/21)
2/28	<b>Tutorial:</b> Introduction to Coding & Toolboxes in Python	Optional but strongly encouraged
3/7	AI & Machine Learning	Modeling Challenge III due (3/7)
3/13-3/17	<b>No Class, Spring Break</b>	
3/21	Multiplexed Imaging & Image Analysis   <i>Spatially-Resolved Biological Data</i>	
3/28	Handling Health Sensor Data   <i>Time-Varying Biological Data</i>	
4/4	Time- and Space-Varying Biological Data	Modeling Challenge IV due (4/4)
4/11	Graph-Based Modeling	
4/18	Cell-Based Modeling	
4/25, 5/2	Final Project Presentations	<b>Preliminary Reports due for Project (5/2)</b>

5/2	Last Day of Classes	
5/10	Final Project Reports due	<b>Modeling Project DUE (5/10)</b>

## COURSE MANAGEMENT AND POLICIES

---

### Instructor-Initiated Drops

**This course uses instructor-initiated drops for students who exceed the absence and/or missed assignment limit. Therefore, up to the last day for students to withdraw from an individual course, March 27, you will be dropped for exceeding two unexplained assignments and/or absences.** Students will receive at least one courtesy warning when approaching the absence/missed assignment limit. Notification will be sent via ASAP to the student's email address. A subsequent absence or missed assignment will result in being dropped from the course. Notification of being dropped will also be sent via ASAP to the student's email address. *This drop does not affect enrollment in other courses.* **Please consult the [Dropping Courses webpage](#) for further details on the process and appeals.**

### Student Code of Conduct and Scholastic Dishonesty

The Student Code of Conduct is Section B of the Appendices in the Student Information Bulletin. Scholastic Dishonesty is listed in the Student Code of Conduct (Sec. B of the Appendices) under [Sec. 203](#).

### Copyright and Fair Use

It is important to understand the issue of intellectual property rights. You may not use the images or thoughts of others for profit or gain without their written permission. The UTSA library has a [Copyright Laws and Public Performance Rights](#) (PPR) page.

### Students with Disabilities

The University of Texas at San Antonio, in compliance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act, provides "reasonable accommodations" to students with disabilities. Only those students who have officially registered with Student Disability Services and requested accommodations for this course will be eligible for disability accommodations. Instructors at UTSA must be provided official notification of accommodation through Student Disability Services. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.utsa.edu/disability](http://www.utsa.edu/disability) or by calling Student Disability Services at (210) 458-4157. Accommodations are not retroactive.

### Family Educational Rights and Privacy Act (FERPA)

FERPA grants students the right to control certain disclosures of their educational records. For a full explanation of your rights and to grant access to FERPA educational records, go to [Student Catalog Annual FERPA Letter](#) and [One Stop Enrollment – FERPA Proxy Access](#). Without your consent or authorization of proxy access, UTSA may release [Directory Information](#), such as but not limited to your name, email, phone,



place of birth, and photograph, unless you have opted out of the release of Directory Information. To opt out, go to [Restrict Directory Information Form](#). ***Mandatory Reporting of Sexual Misconduct and Reporting of Health and Safety Information:*** If a student discloses an incident of sexual misconduct to any UTSA employee (other than to a designated confidential employee such as mental health counselor or PEACE advocate, a UTSA police officer using a pseudonym form or at a public awareness event), that information is not confidential, and the UTSA employee must report all known information to the UTSA Office of Equal Opportunity Services. Employees may also report any concerns about the health and safety of students or others to other school officials and/or law enforcement. For a complete list of exceptions to FERPA, please see [Student Catalog Annual FERPA Letter](#) and [HOP 5.01](#).

### **Video and audio recording**

As the instructor of this course, I may record meetings and lessons. You are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Recordings may not be published, reproduced, or shared with those not in the class. If the instructor or a UTSA office plans any other uses for the recordings, consent of the students identifiable in the recordings is required before such use unless an exception is allowed by law. For more information on your privacy and class recordings, review [Student Privacy \(FERPA\) in Virtual Classrooms and Other Educational Recordings](#) and the [Guide to Secure Video Conferencing Tools](#).

Note: The syllabus is subject to change at the instructor's discretion. Any changes/corrections to the course materials, assignment dates, or other updates will be communicated to the students ahead of time. You are responsible for checking Blackboard for corrections or updates to the syllabus.