BMED 3310 Syllabus

Biotransport, A/A01/A02/A03, 3 Credits
Fall 2026

Instructor Information

Instructor	Email
James Blumling	jblumling@gatech.edu
Gabriel Kwong	gkwong@gatech.edu

General Course Information

Description

The course introduces students to the fundamentals of momentum, heat, and mass transport and their application to biomedical engineering problems. Students will build upon and apply a breadth of knowledge in all three domains of Biotransport.

Topics include, but are not limited to: hydrostatics, Reynolds transport theorem, Bernoulli's equation, the Navier-Stokes equation, conduction and diffusion, heat and mass convection, heat and mass differential balances.

Course Learning Outcomes

1. Identify, formulate, and solve biomedical problems involving mass, momentum and/or heat transfer (Student Outcome 1)
    a. Formulate differential and/or integral equations that represent the physical situation of biomedical problems involving mass, momentum and/or heat transfer (or combinations thereof) and determine appropriate boundary conditions.
    b. Apply conservation laws of fluid flow to describe the system (pressure drops, velocities, velocity profiles, shear stresses, shear rates) for various geometries, particularly for flow through conduits.
    c. Apply differential and/or integral equations to determine concentrations or temperatures at a particular point or concentration/temperature profiles with and without biochemical reactions, and to determine mass/heat fluxes, respectively.
2. Explain analogies between heat and mass transfer, and employ them to solve biomedical engineering problems (Student Outcomes 1)
    a. Distinguish between modes of heat or mass transfer, explain analogies between heat and mass transfer, and apply the correct equations to describe each mode.
    b. Determine convective mass/heat transfer coefficients using appropriate analogies for the geometric situation.

Required Course Materials

There are no required textbooks or outside resources. All necessary course materials will be available to download from Canvas.

Grading Policy:

Assessment Type	Category Weight
Prerequisite Assessment	4%
Quizzes	20% (2 x 10%)
Midterm Exams	30% (2 x 15%)
Final Exam	25%
Homework	8% (4 x 2%)
Project	8% (4 parts x 2%)
PSS Participation and Engagement	5% (10 x 0.5%)
TOTAL	100%

The preliminary grading scale to be used when assigning final grades:

>=90% - 100%	A
>=80% - 90%	B
>=70% - 80%	C
>=60% - 70%	D
<60%	F

Based on instructor discretion, this scale may be adjusted. Any adjustment to this scale will be solely for students' benefit. Note that students' final grades will be based only on the components outlined above. Requests from students to be allowed to submit supplemental material before or after the end of term to increase their grades will not be considered.

Description of Graded Components

Diagnostic Prerequisite Assessment: There will be a diagnostic quiz given early in the semester. This assessment will cover knowledge from prerequisite classes that is critical to success in Biotransport.

Quizzes: There will be two quizzes throughout the semester. They will occur about midway through each of the two course segments (Fluid Mechanics and Heat/Mass transport). Quizzes will be given on Fridays during PSS.

Midterm Exams: There will be two midterm exams. They will occur at the end of each of the two course segments (Fluid Mechanics and Heat/Mass Transport). They will cover the entirety of the content for the relevant course segment. Midterm exams will be given on Fridays during PSS. They will include more complex and in-depth questions than quizzes.

Final Exam: There will be one final exam that will be given during the assigned final exam period. It will cover all the course material and will include questions of varying levels of depth and complexity. To acknowledge student growth, an exam improvement bonus will be automatically calculated at the end of the semester, if applicable. This bonus will be added to the student's final grade percent (out of 100%). This bonus will be calculated according to the following formula:

$$\text{Bonus \%} = \frac{\text{Final Exam \%} - \text{Lowest Midterm \%}}{10}$$

Homework: There will be four homework assignments given through the semester Two such assignments will be designated for each of the two course segments (Fluid Mechanics and Heat/Mass transport). They will each cover distinct portions of the course content. For these assignments, students are encouraged to engage and discuss with one another, but submitted work must be their own.

Computational Project: There will be a computational project introduced between the two course segments focused on dimensional analysis. This project will be broken down into four parts with separate due dates. MATLAB will be required for this project.

PSS Participation and Engagement: see Attendance and Participation below.

USG Required Course Policies

Attendance and Participation

Lecture attendance is not mandatory but is strongly encouraged. Those that attend lecture regularly generally perform better.

Active, routine participation in PSS will be expected. You must *attend and engage for the entirety* of 10 PSS sessions (this includes the quiz and exam days) to receive full participation credit. This gives you 4 free absences. Excused absences will count as a free absence. Requests for additional excused absences will be granted at the discretion of the instructors and only if all free absences were excused. Please plan accordingly and reach out to your PSS instructor, if necessary. Participation credit is at the discretion of your instructors and TAs — if you are present but not clearly engaged with the PSS process, you may not receive credit for that day.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Additional Georgia Tech Required Policies

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Optional Course Expectations, Policies, and Resources

Pre- &/or Co-Requisites

BMED 2110 and MATH 2551 and MATH 2552 and PHYS 2211

Collaboration, Group Work, and Use of Generative AI

Collaboration with other students is expected during PSS and encouraged for homework assignments. Collaboration is strictly prohibited on all in-class assessments (quizzes and exams). Regardless of whether collaboration is permitted, students are always expected to submit their own work for assignments.

AI programs (e.g. ChatGPT) may be used as a learning tool but should not be a substitute for your own independent and critical thinking. Additionally, it is important to note that the material generated by these programs may be inaccurate or incomplete. Be aware that an over-reliance on AI programs can stifle your learning and impact your performance on AI-prohibited assessments.

AI use is strictly prohibited on in-class assessments (quizzes and exams). For assignments completed outside of class (e.g. homework), you may not submit any work generated by an AI program as your own. Violations of this policy will be considered academic misconduct.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

We expect that all students will complete every assignment at the scheduled times. However, we understand that sometimes you may experience a conflict or event that prevents timely submission. In this case, you must notify your professor as soon as practicably possible (preferably before the event). The reason for your absence must be communicated and evidence provided. For absences that are not institute-approved, we ask that students communicate with the Office of the Dean of Students and have them send us a letter. This is particularly important for personal and medical matters — to prevent the proliferation of confidential information, medical documentation should be provided to the Office of the Dean of Students; the office will send a letter to instructors validating the excuse. At the instructors' discretion, failure to provide suitable evidence and/or timely notification will automatically result in a mark of zero.

In the case of a missed quiz, if instructors agree and the absence is excused, the quiz will be excused. No late make-up quizzes will be allowed for any reason. *This only applies if the student was unable to provide prior notice of the absence and re-schedule for an earlier time.*

In the case of a missed exam, a make-up exam will be available to the student only in cases of Institute-approved activities or extreme circumstances, which require documentation for the absence. Missed exams must be made up within one week of the original due date. *This only applies if the student was unable to provide prior notice of the absence and re-schedule for an earlier time.*

If you want to schedule an alternate time for a quiz or exam (either in-person or at a testing center), we expect it to be scheduled for either before the planned assessment time or later the same day. Requests to schedule an assessment after the intended day will be denied barring extreme circumstances. All alternate testing requests must be approved by one of the instructional team.