Biotransport

Last Updated: Thu, 12/18/2025

Course prefix: BMED

Course number: 3310

Section: A

CRN (you may add up to five):
27249 27320 27321 27322

Instructor First Name: James

Instructor Last Name: Blumling

Semester: Spring

Academic year: 2026

Course 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)
    1. 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.
    2. 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.
    3. 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)

1. Distinguish between modes of heat or mass transfer, explain analogies between heat and mass transfer, and apply the correct equations to describe each mode.
2. Determine convective mass/heat transfer coefficients using appropriate analogies for the geometric situation.

Required course materials:

All course materials will be available to download from Canvas.

WEB RESOURCES

Canvas: Look for **Biotransport (BMED 3310) – Spring 2026**. Resources may be printed out from the web page. This site will be used to send important announcements to the class. Please verify that you are listed in the membership and check Canvas often.

Microsoft Teams: We will be using Microsoft Teams for class discussion. Channels will be set up to facilitate peer discussion on various topics. Rather than emailing questions to the teaching staff, we encourage you to post your questions here.

Zoom: Some office hours may be held in Zoom.

Grading policy:

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

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

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 below. 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.

Diagnostic Prerequisite Assessment (4%): There will be a diagnostic assessment given in PSS during the third week of the semester. This assessment will cover knowledge from prerequisite classes that is critical to success in Biotransport.

Quizzes (2 x 10%): There will be two quizzes throughout the semester (see course schedule). These quizzes will be given during the designated PSS periods.

Midterm Exams (2 x 15%): There will also be two midterm exams given during the PSS periods. One will be given during each of the two course segments (Fluid Mechanics and Heat/Mass Transport).

Final Exam (25%): There will be a cumulative final exam given during the final exam slot.

- **Exam Improvement Bonus:** The instructional team values student improvement. 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:
    - Bonus % = (Final Exam % – Lowest Midterm %) / 10

Homework (4 x 2%): There will be four homework assignments (two for Fluid Mechanics and two for Heat/Mass Transport). Students must each submit their own assignment but are encouraged to work with one another.

Computational Project (4 parts x 2%): 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 (10 x 0.5%): 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 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.

Survey: To understand both your expectations for this class and how you are experiencing the class, we will administer three ungraded surveys during the semester. These surveys will be administered through Canvas.

Missed Work Policies: We expect that all students will complete every assessment at the scheduled times. However, we understand that sometimes you may experience a problem that doesn't allow you to complete the assessment. In this case, you must notify your professor as soon as practically possible (preferably before the event). The reason for your absence must be communicated and evidence provided. To prevent the proliferation of confidential information, medical documentation should be provided to the Dean of Students office; the Dean of Students office will send a letter to the instructors validating the medical 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, then a missed quiz will be excused, or arrangements can be made to take the quiz earlier. No late make-up quizzes will be allowed for any reason.

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.

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.

Honor Code: Students are expected to abide by the GT Honor Code (https://policylibrary.gatech.edu/student-life/academic-honor-code) at all times. The objective of the honor code is "to prevent any student from gaining an unfair advantage over other students through academic misconduct". Starting with the first offense, any potential violations of the honor code will be immediately reported to the Office of Student Integrity to be reviewed. To preserve the integrity of the classroom and the instructor-student relationship, we cannot use personal discretion in instances of potential honor code violations – ***consider this the first and only warning***. For any questions involving these or any other Academic Honor Code issues, please consult your instructor or the student code of conduct. Included in this policy is the use of ANY resources not allowed on an assignment. Specific examples of this are the use of sites like Chegg or Course Hero for help on quizzes or exams. We do monitor this type of activity. We consider the use of ANY resources not allowed on an assignment as a violation of the Honor Code and will be treated as such. The instructional team may collect photo/video evidence to document instances of suspected academic misconduct.

Regrade Requests: Regrade requests must be submitted to your instructor within one week of the graded materials being initially returned. The item to be regraded must be accompanied by a completed regrade request form (on Canvas) from the student explicitly identifying the reason(s) for the requested regrade. Whenever an assignment is regraded, the entire assignment will be regraded.

Artificial Intelligence (AI) Use Policy: 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.

Attendance policy:

Lecture: attendance is not mandatory but is strongly encouraged. Success in this class is strongly linked with active engagement.

PSS Participation and Engagement: 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 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 honesty/integrity statement:

Students are expected to maintain the highest standards of academic integrity. All work submitted must be original and properly cited. Plagiarism, cheating, or any form of academic dishonesty will result in immediate consequences as outlined in the university's academic integrity policy.

Honor Code: Students are expected to abide by the GT Honor Code (https://policylibrary.gatech.edu/student-life/academic-honor-code) at all times. The objective of the honor code is “to prevent any student from gaining an unfair advantage over other students through academic misconduct”. Starting with the first offense, any potential violations of the honor code will be immediately reported to the Office of Student Integrity to be reviewed. To preserve the integrity of the classroom and the instructor-student relationship, we cannot use personal discretion in instances of potential honor code violations – ***consider this the first and only warning***. For any questions involving these or any other Academic Honor Code issues, please consult your instructor or the student code of conduct. Included in this policy is the use of ANY resources not allowed on an assignment. Specific examples of this are the use of sites like Chegg or Course Hero for help on quizzes or exams. We do monitor this type of activity. We consider the use of ANY resources not allowed on an assignment as a violation of the Honor Code and will be treated as such. The instructional team may collect photo/video evidence to document instances of suspected academic misconduct.

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Core IMPACTS statement(s) (if applicable):

This course is not eligible to satisfy any Core IMPACTS area attributes.