**BMEN 5315 – Computational Methods in Biomedical Engineering**
**BMEN 4310 – Biomedical Modeling**
**Department of Biomedical Engineering**
**University of North Texas**
**Fall 2026**

**INSTRUCTOR**

Fateme Esmailie, PhD
Office: Discovery Park K240A
E-mail: fateme.esmailie@unt.edu
Lectures: Tu Th 4:10-5:00 pm (NTDP D201)
Office Hours: Tu,Th, 3:00 – 3:45 pm (CT) (Office K240A)
Laboratory Sessions:
Wednesday 06:30 -09:20 pm (CT) NTDP E225B
Monday 07:30 am – 10:20 pm (CT) NTDP E225B

**CLASS TA**

Victoria Gnenema

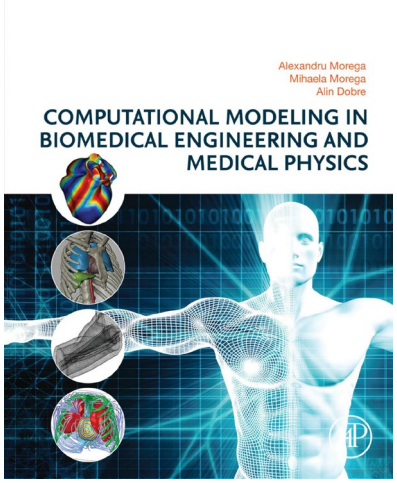
ComeninGnenema@my.unt.edu

**TEXTS**

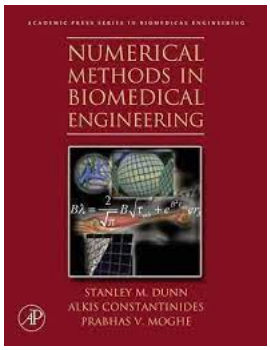
Required Text(book)s:

1. Class Notes/Lectures and Posted Reading Assignments will be important resources

2. Computational Modeling in Biomedical Engineering and Medical Physics, Alexandra Morega, Mihaela Morega, Alin Dobre, eBook ISBN: 9780128178980, Hardcover ISBN: 978-0-12-817897-3, Academic Press – You can find it at UNT library



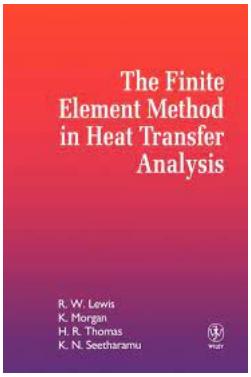

3. Numerical Methods in Biomedical Engineering by Stanley Dunn, Alkis Constantinides, Prabhas Moghe, 1st Edition, eBook ISBN: 9780080470801, Hardcover ISBN: 9780121860318, Academic Press




Picture from Google Books

**Additional References:**

4. The Finite Element Method in Heat Transfer Analysis by R. W. Lewis, K. Morgan, H. R. Thomas, K. N. Seetharamu, ISBN 047193424;0471943622, John Wiley & Sons Ltd




Picture from Google Books

5. V&V 40–2018, Assessing Credibility of Computational Modeling through Verification and Validation: Application to Medical Devices, Publisher: ASME, Publish Date: 2018, ISBN: 9780791872048

6. V&V 20–2009, Standard for Verification and Validation in Computational Fluid Dynamics and Heat Transfer, Publisher: ASME, Publish Date: 2009, ISBN: 9780791832097

**COURSE DESCRIPTION**

Computational Methods in Biomedical Engineering (BMEN 5315) and Biomedical Modeling (BMEN 4310) is an introduction to equations and numerical analysis techniques important to the description of living systems and medical devices. In this course, we will focus on numerical methods that are applied in biomedical computations. Assessing the credibility of computational modeling in medical devices and applications will be discussed in this course.

**PREREQUISITES**

BMEN 5315: Calculus, Linear Algebra, Transport Phenomena
BMEN 4310: Calculus, Linear Algebra, Transport Phenomena, BMEN 3321 and senior standing

**COURSE GRADING METRICS**

| Final Composite Score to be Based On: | weighting |
|---|---|
| Homework | 10% |

| | |
|---|---|
| Lab and lecture Attendance | 15% |
| Quizzes | 10% |
| Mid-term Exam | 25% |
| Lab Reports | 15% |
| Final Exam/Project | 25% |

Letter Grade Cutoffs

| Score | Grade |
|---|---|
| A | 90-100% |
| B | 80- < 90 |
| C | 70- < 80 |
| D | 60- < 70 |
| F | < 60% |

**HOMEWORK**

a) Homework assignments will be made during the semester along with a due date.
b) All assignment sets should be scanned (use a smart phone app or a dedicated printer/copier/scanner) and uploaded to *Canvas*.
c) Homework must be turned in by **5:00 p.m.** on the assignment due date.
d) **No late assignment is accepted**, unless there is an excuse that falls within the allowable reason on UNT Policy.
e) Homework solutions will be made available on the *Canvas* course site after the assignment due date.
f) Students are expected to work all assigned problems, check their solutions against the posted solutions, and rework problems if necessary.
g) Unofficial test and homework scores will be listed on the course *Canvas* site. It is the student's responsibility to check that scores have been properly recorded.
**h) Requests for reviewing any graded work must be made by submitting a detailed request through *Canvas* within one week of the grade being posted. After one week of posting the grades no regrade request is accepted.**

**EXAMS**

a) One mid-term exam and one final exam are scheduled. All exam scores will be included in the final determination of grades.
b) In the event of a missed exam, students will be required to provide a valid explanation for the conflict and will be required to complete a make-up exam. Please notify the instructor ASAP if you are unable to take an exam at the scheduled time. The make-up exam will not be same as the exam other students take during the scheduled time of the exam.
d) The midterm exam will be offered during the posted class meeting time 4:00 pm – 4:50 pm on dates indicated in the schedule.
e) Exams will be in person.
f) Requests for reviewing any graded exam should be made by submitting a detailed request through *Canvas* within one week of the exam grade being posted. Any regrade request after that is not allowed.

**QUIZZES**

Quizzes will be taken on *Canvas*. Each quiz will consist of multiple-choice questions.

**IMPORTANT DATES**

**Final Exam**
Dec. 05 (Saturday) Final Exam (03:30-05:30 pm (CT))
**Midterm Exam**
Oct. 06th (4:10 pm – 05:00 pm (CT))

**COURSE OBJECTIVES**

At the completion of this course, students will be able to:

1. Identify and execute effective approaches to solving biomedical engineering problems and effectively communicate their solutions.

2. Gain an understanding of biomedical modeling
3. Understand the application of modeling to various biomedical engineering applications
4. Develop a knowledge of Finite Element modeling using Comsol and Matlab
5. Discuss the principles of quantitative approaches to modeling
6. Apply simulation techniques to design and evaluate a new medical device
7. Prove the credibility of numerical simulations using ASME Validation and Verification standards

**ABET CRITERIA:**

1. ABET OUTCOME 1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. ABET OUTCOME 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

**CLASS POLICIES**

a) Students are responsible for all material provided in the recorded lectures and handouts.

b) All work (homework, quizzes, and tests) submitted for grading should represent your individual effort. However, studying and working with your peers (on outside class assignments) is not only acceptable, but greatly encouraged. Study groups can provide an extremely valuable resource to students, and you are encouraged to join one.

c) Submitting work from others (fellow students, solutions manual, Chegg, etc.) will be considered academic misconduct. Plagiarism of ideas or work as well as giving or receiving unauthorized information on examinations will be considered academic misconduct. All academic misconduct will be dealt with severely and may result in a course grade of E. Refer to the academic misconduct policy on the University of North Texas website. The definition of academic misconduct, including a list of examples, should be also be reviewed.

d) **Attendance**: **You MUST attend the class in person.** Please refer to the University attendance policy at https://policy.unt.edu/policy/06-039. There are a few exceptions that make you eligible to skip a class that are listed in the university policy (https://policy.unt.edu/sites/default/files/06.039%20Student%20Attendance%20and%20Authorized%20Absences.pdf)

e) Using phones, headphones, ipods, and any device that distract your attention and others attention in the class is prohibited.

f) Attendance in lectures and lab sessions is mandatory. Attendance in lectures and lab sessions is mandatory.

g) In this class, everyone's perspectives are valued, and we are committed to treating one another—and our learning environment—with mutual respect and consideration.

**RELEVANT POLICIES**

https://clear.unt.edu/student-support-services-policies

**COMMUNICATIONS**

*My email*: Email is the preferred method of contact. Most emails will be answered within 48 hours. I will not respond to emails during the weekend and holidays and outside of business hours.

*Your email*: Direct communications with students will be made via your university email address as compiled by the registrar. If your university email address is not checked frequently, you should update it and forward to your active email address through CIS. You may also want to set *Canvas* to notify you when items are posted to the course site.

*Office hours*: Office hours are blocks of time that are reserved for you. Please check office hours before making an email request for an appointment outside of office hours. Changes to office hours will be announced on *Canvas*.

**CLASS WEB SITES**

1) ***Canvas*:** All handouts (syllabus, homework assignments, homework and test solutions, etc.) will be distributed in pdf format at the course web site. Students must be registered with the *Canvas* course site by August 29th, 2025 to access the site throughout the semester. Electronic communication with all students will be made by a class email list compiled by the registrar, which is connected to *Canvas*. The *Canvas* gradebook is unofficial. Its purpose is to communicate all scores recorded for student work. It is your responsibility to verify that the correct scores have been recorded.

2) You must attend the lectures and lab sessions in-person, listen to the lecture and work on the assigned computer examples during the lab session.

**HOMEWORK GUIDELINES**

The following format for homework is suggested as it provides the opportunity to systematically think about a problem before attempting the solution. The format consists of the following steps:

1. *Known:* After carefully reading the problem, state briefly and concisely what is known about the problem. Do not repeat the problem statement.
2. *Find:* State briefly and concisely what must be found.
3. *Schematic:* Draw a schematic of the physical system. If application of the conservation laws is anticipated, represent the required control surface by dashed lines on the schematic. Identify relevant heat transfer processes by appropriately labeled arrows on the schematic.
4. *Assumptions:* List all pertinent simplifying assumptions (if any).
5. *Properties:* Compile property values needed for subsequent calculations and identify the source from which they were obtained.
6. *Analysis:* Begin your analysis by applying appropriate conservation laws, and introduce rate equations as needed. Develop the analysis as completely as possible before substituting numerical values. Perform calculations needed to obtain the desired results.
7. *Comments:* Discuss briefly your results. Such a discussion may include a summary to key conclusions, an inference of trends, and a critique of the original assumptions.
8. *Computer Solutions:* If a computer solution is developed, be sure a copy of the program is included in addition to the items above.

Other points to keep in mind as you prepare your homework include:

1. On each page, use a heading that includes: your name, problem number, due date, and page number.
2. Use brief comments - in good English - to make your thinking clear, to connect parts of the problem, and to indicate where data and equations were obtained.
3. Clearly show all steps of the solution. Partial credit can only be considered if a sufficient amount of detail is provided.
4. Be sure your work is neat and readable. This will maximize your chances of receiving all the credit the work deserves.
5. Be sure units are correct, consistent, and clearly stated.
6. Show the appropriate number of significant figures.
7. Clearly identify the answer (box, arrow, etc.)
8. Use only one side of the paper.
9. Show only one problem solution per page.
10. Keep work inside the one-inch margin.