

BMEN 3321 – Biomaterials

Spring 2025

Instructor: Dr. Melanie Ecker

Office: K240C

Office Hours: Mon & Wed 12:00-1:00 pm.

Email: melanie.ecker@unt.edu

Course Structure:

This will be an in-person class with additional content available on Canvas.

Class Schedule:

Mo & We 10:00AM - 11:20AM

The instructor will deliver content related to this course and will make the slides available to the students on Canvas. In addition, the students are expected to contribute to the class by giving presentations related to the course contents (see Attendance and Academic Performance for more information).

Course Description:

BMEN 3321. Biomaterials. 3 hours. Introduction to the properties of natural and man-made materials commonly encountered in biomedicine and biomedical engineering; the basics of material structures, including crystalline and chemical structure and microstructure; and characteristics of the materials will be developed from the microscopic origins.

Brief List of Topics:

- Biomaterials Introduction and History
- General Properties of Materials
- Metallic Biomaterials
- Polymeric Biomaterials
- Bioceramics
- Composite Biomaterials
- Natural Biomaterials
- Materials Characterization
- Host response to Biomaterials
- Tissue Engineering
- Applications and Examples

Materials:

No textbooks are required. All course materials will be posted on Canvas, including lecture notes, slides, assignments, reading, etc.

Recommended reading:

- Introduction to Biomaterials – Basic Theory with Engineering Applications, by C. Mauli Agrawal, et al. (Cambridge University Press, 2014)
- Biomaterials: A Basic Introduction, by Qizhi Chen, et al. (CRC Press, 2014)
- Biomaterials: An Introduction, by Joon Park and R.S. Lakes (Springer, 2007)
- Biomaterials Science: An Introduction to Materials in Medicine, by Buddy D. Ratner, et al. (Elsevier Academic Press, 2004)

Prerequisites: PHYS 1710, CHEM 1410, BMEN 3310

Course Objectives:

This course is designed to provide a comprehensive introduction to the world of biomaterials, linking fundamental properties of synthetic and natural materials to biological systems and biomedical applications.

Students are expected to:

- (1) Understand fundamental knowledge of biomaterials, including metals, polymers, ceramics, and natural materials.
- (2) Be familiar with biomaterial requirements for certain biomedical applications.
- (3) Be able to apply principles for designing biomaterials in a given application.

ABET Student Outcomes:

This course contributes to the following ABET student outcomes:

- **Outcome 6:** *An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.*
- **Outcome 7:** *An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.*

*Both outcomes will be evaluated as **indirect outcomes** through student surveys.*

Course Technology & Skills:

Minimum Technology Requirements

- Computer

- Reliable internet access
- Speakers
- Microphone
- Webcam
- Microsoft Office Suite
- Canvas Technical Requirements (<https://clear.unt.edu/supported-technologies/canvas/requirements>)

Computer Skills & Digital Literacy

- Using Canvas
- Using spreadsheet programs
- Using presentation and graphics programs

Course Requirements:

Attendance and Academic Performance:

1. Regular and punctual class **attendance** is expected. Attendance is taken during every class meeting with [iClicker](#) and begins on the first day of the semester.
2. **Participation:** Students are expected to answer questions and discuss the topics related to the course materials in the classroom and on reflection boards on Canvas. This will count towards your participation grade. There will be short **quizzes**, minute papers, and background knowledge probes without prior notification throughout the semester. These activities will be available on Canvas.
3. **Homework:** Homework is due at the designated time through canvas submission. There will be three homework assignments, and the lowest homework grade will be dropped off.
4. **Oral Presentation:** One assignment will be an **oral research paper presentation** similar to a journal club. The purpose of this assignment is not only to learn how to critically read a research paper but also to communicate scholarly content effectively in a team. Students will **work in groups of 4** unless otherwise assigned. Each group will give a 10-minute presentation +3 min Q&A to the class at the end of the semester. *All group members must present and participate* during the presentation. Any group member who is not present for their group presentation will receive a *zero* for the entire presentation grade. Presentation topics should be selected from any closely course-related *original research* (non-review/opinion) journal publications within 5 years (2020-today). More details will be posted on Canvas later. In addition to the presentation, each group member will be asked to prepare a one-page summary of the selected publication (**journal abstract** style). The abstract will be an individual assignment. The template will be posted on Canvas later.
5. You will be asked to prepare a **scientific poster** based on a research paper of your choice (*original research journal publications within 5 years*). You need to pick a paper that is relevant to the course content. Create the poster as if the research presented in the paper was your own, and you want to show the work at a scientific meeting/conference to your peers.
6. **Exams:** Two sectional exams will be given during the semester. A laptop and *Lockdown Browser* are required. Each exam will cover materials from the previous lecture section

only. Exam questions will combine multiple choices, true/false, short answers, fill-in-the-blanks, matching, etc.

7. **Important Dates:**

- 3/5/25: Midterm Exam (during class time in K120)
- 3/10/25: Spring break (no class)
- 3/12/25: Spring break (no class)
- 3/26/25: Poster Due
- 4/21/25: Presentations + abstracts (groups 1-5)
- 4/23/25: Presentations + abstracts (groups 6-10)
- 4/28/25: Presentations + abstracts (groups 11-14)
- 5/03/25: Final Exam (Saturday 8-10 am, online)

Grade Evaluation:

Attendance	10%
Class Participation	10%
Homework	15%
Oral Presentation	15% (10% + 5%)
Poster	10%
Exams	40% (20% + 20%)

Grade Policy:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
E	< 60%

Class Policies:

Attendance Policy: Regular and punctual class **attendance** is expected. Attendance is taken during every class meeting and begins on the first day of the semester.

- **Excused absences** do not lower your overall grade in this class. Excused absences are those that are both valid and verifiable, i.e., illness, bereavement, and school-related activities. I will ask for verification, and I expect you to be responsible for getting any notes/materials you missed.
- Two **unexcused absences** are permitted, no questions asked (although I encourage you to be here for every class meeting). Each class missed after that will reduce your final grade. If a special problem should arise, please see me. If an emergency occurs and you cannot notify me in class, leave a message.

Students are expected to attend class meetings regularly and to abide by the attendance policy established for the course. You must communicate with the professor before being absent so you and the professor can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor if you cannot attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

Late Submission Policy: Homework assignments must be submitted via Canvas on the due date. Late submissions will be accepted, but there will be a penalty of **10% per day** for delays (even if you submit 1 minute after midnight).

Plagiarism: Turnitin will be applied to check for similarity. *Similarity reports of more than 30% will be considered plagiarism and will not be accepted, resulting in a zero grade.* You may always check the similarity report once submitted to Canvas and revise and resubmit before the due time. The last submitted version before the due date will only be graded.

Use of generative AI: The use of AI, such as ChatGPT, Gemini, etc., is not allowed for written assignments (including reflection boards, quizzes, and homework) and will result in a zero grade. An AI checker will be used to verify the amount of AI used. I want you to think for yourself. You won't learn critical thinking and problem-solving skills using generative AI instead of your own brain.

Withdraws: Note that students wishing to drop the course must take appropriate action (Details can be found in the following link: <http://essc.unt.edu/registrar/schedule/withdraw.html>). You are responsible for ensuring all of the requisite paperwork is submitted. Ceasing attendance does not automatically drop you from the course.

Class Recordings: Some classes may be recorded to accommodate ill students who can't attend in person. Class recordings are reserved for use only by students in this class for educational purposes. The recordings should not be shared outside the class or outside the Canvas LMS in any form. Failing to follow this restriction violates the UNT Code of Student Conduct and could lead to disciplinary action.

Best Practices:

- Treat your instructor and classmates with respect in email or any other communication.
- While the freedom to express yourself is a fundamental human right, any communication that utilizes cruel and derogatory language based on race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal, or state law will not be tolerated.
- Speak from personal experiences. Use "I" statements to share thoughts and feelings. Try not to speak on behalf of groups or other individuals' experiences.
- Use your critical thinking skills to challenge other people's ideas instead of attacking individuals.
- Proofread and fact-check your sources.

- Students are encouraged to discuss class material and homework to understand concepts better. However, all the homework you submit must be your own. Direct copying of a solution (from a friend or a book) will be considered plagiarism and a violation of the University Honor Code.
- Please use Canvas regularly, as it will contain course contents and materials, assignments, quizzes, announcements, and reflection boards.
- All students are responsible for announcements made in a lecture or on canvas.
- Students must read the assigned materials thoroughly and search related literature using PubMed, Web of Science, or Google Scholar.
- Be cautious when using humor or sarcasm, as tone is sometimes lost in an email or discussion post, and your message might be taken seriously or sound offensive.
- Be careful with personal information (both yours and other's).
- Do not send confidential information via email.
- It is the responsibility of students with certified disabilities to provide the instructor with appropriate documentation from the Dean of Students Office (see <http://www.unt.edu/oda>).

Equality Statement: The instructor is dedicated to establishing a learning environment that promotes diversity among the students, including (but not limited to) race, class, culture, religion, gender, sexual identity, and physical ability. It is crucial that this is a safe classroom environment. We will practice being generous and respectful members of our classroom community. Anyone noticing discriminatory behavior in this class or who feels discriminated against should immediately bring it to the instructor's attention.

Americans with Disabilities Act: The University of North Texas does not discriminate on the basis of an individual's disability and complies with Section 504 and Public Law 101-336 (Americans with Disabilities Act) in its admissions, accessibility, treatment, and employment of individuals in its programs and activities. A copy of the College of Engineering ADA Compliance Document is available in the Dean's Office.

All reasonable accommodations will be made to facilitate special needs. If special accommodation is required, the student must first meet with the staff of the Office of Disability Accommodation (ODA), Union Suite 322, (940) 565-4323. After meeting with that office, please contact me to discuss what accommodation will be necessary. For more information, see <http://www.unt.edu/oda>.

It is the responsibility of the student to inform the instructor of any disabling condition that will require modifications by the 12th class day.

Course Evaluation: Student Perceptions of Teaching (SPOT) is the student evaluation system for UNT, and it allows students the ability to confidentially provide constructive feedback to their instructor and department to improve the quality of student experiences in the course. Please submit your evaluation, as it helps me reflect on my teaching and improve my delivery methods.

Getting Help

Technical Assistance

Part of working in the online environment involves dealing with the inconveniences and frustration that can arise when technology breaks down or does not perform as expected. Here at UNT we have a Student Help Desk that you can contact for help with Canvas or other technology issues.

UIT Help Desk: [UIT Student Help Desk site](http://www.unt.edu/helpdesk/index.htm) (<http://www.unt.edu/helpdesk/index.htm>)

Email: helpdesk@unt.edu

Phone: 940-565-2324

In Person: Sage Hall, Room 130

Walk-In Availability: 8am-9pm

Telephone Availability:

- Sunday: noon-midnight
- Monday-Thursday: 8am-midnight
- Friday: 8am-8pm
- Saturday: 9am-5pm

Laptop Checkout: 8am-7pm

For additional support, visit [Canvas Technical Help](#)

(<https://community.canvaslms.com/docs/DOC-10554-4212710328>)

Student Support Services

UNT provides mental health resources to students to help ensure there are numerous outlets to turn to for wholehearted care and for students in need, regardless of the nature of an issue or its severity. Listed below are several resources on campus that can support your academic success and mental well-being:

- [Student Health and Wellness Center](https://studentaffairs.unt.edu/student-health-and-wellness-center) (<https://studentaffairs.unt.edu/student-health-and-wellness-center>)
- [Counseling and Testing Services](https://studentaffairs.unt.edu/counseling-and-testing-services) (<https://studentaffairs.unt.edu/counseling-and-testing-services>)
- [UNT Care Team](https://studentaffairs.unt.edu/care) (<https://studentaffairs.unt.edu/care>)
- [UNT Psychiatric Services](https://studentaffairs.unt.edu/student-health-and-wellness-center/services/psychiatry) (<https://studentaffairs.unt.edu/student-health-and-wellness-center/services/psychiatry>)
- [Individual Counseling](https://studentaffairs.unt.edu/counseling-and-testing-services/services/individual-counseling) (<https://studentaffairs.unt.edu/counseling-and-testing-services/services/individual-counseling>)

Other student support services offered by UNT include

- [Registrar](https://registrar.unt.edu/registration) (<https://registrar.unt.edu/registration>)
- [Financial Aid](https://financialaid.unt.edu/) (<https://financialaid.unt.edu/>)
- [Student Legal Services](https://studentaffairs.unt.edu/student-legal-services) (<https://studentaffairs.unt.edu/student-legal-services>)
- [Career Center](https://studentaffairs.unt.edu/career-center) (<https://studentaffairs.unt.edu/career-center>)

- [Counseling and Testing Services](https://studentaffairs.unt.edu/counseling-and-testing-services) (<https://studentaffairs.unt.edu/counseling-and-testing-services>)
- [UNT Food Pantry](https://deanofstudents.unt.edu/resources/food-pantry) (<https://deanofstudents.unt.edu/resources/food-pantry>)

Academic Support Services

- [Academic Resource Center](https://clear.unt.edu/canvas/student-resources) (<https://clear.unt.edu/canvas/student-resources>)
- [Academic Success Center](https://success.unt.edu/asc) (<https://success.unt.edu/asc>)
- [UNT Libraries](https://library.unt.edu/) (<https://library.unt.edu/>)
- [Writing Lab](http://writingcenter.unt.edu/) (<http://writingcenter.unt.edu/>)
- [MathLab](https://math.unt.edu/mathlab) (<https://math.unt.edu/mathlab>)

UNT Policies

Academic Integrity Policy. Academic Integrity Standards and Consequences. According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University. <https://policy.unt.edu/policy/06-003>

ADA Policy. UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website (<https://disability.unt.edu/>). <https://policy.unt.edu/policy/16-001>

Emergency Notification & Procedures. UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). <https://emergency.unt.edu/emergency-notifications>

In the event of a university closure, please refer to Canvas for contingency plans for covering course materials. For more information related to Emergency Guidelines visit: <https://emergency.unt.edu/emergency-guidelines-0>

Equality Statement. The University of North Texas prohibits discrimination and harassment because of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal or state law in its application and admission processes; educational programs and activities; employment policies, procedures, and processes; and University facilities.

The University takes active measures to prevent such conduct and investigates and takes remedial action when appropriate. The University also prohibits and takes actions to prevent retaliation against individuals who report or file a charge of discrimination, harassment, or sexual misconduct; participate in an investigation, or oppose any form of discrimination, harassment, or sexual misconduct.

Sexual Assault Prevention. UNT is committed to providing a safe learning environment free of all forms of sexual misconduct, including sexual harassment sexual assault, domestic violence, dating violence, and stalking. Federal laws (Title IX and the Violence Against Women Act) and UNT policies prohibit discrimination on the basis of sex, and therefore prohibit sexual misconduct. If you or someone you know is experiencing sexual harassment, relationship violence, stalking, and/or sexual assault, there are campus resources available to provide support and assistance. UNT's Survivor Advocates can assist a student who has been impacted by violence by filing protective orders, completing crime victim's compensation applications, contacting professors for absences related to an assault, working with housing to facilitate a room change where appropriate, and connecting students to other resources available both on and off campus. The Survivor Advocates can be reached at SurvivorAdvocate@unt.edu or by calling the Dean of Students Office at 940-565- 2648. Additionally, alleged sexual misconduct can be non-confidentially reported to the Title IX Coordinator at oeo@unt.edu or at (940) 565 2759. <https://deanofstudents.unt.edu/sexual-misconduct/reporting-sexual-misconduct>

Retention of Student Records. Student records pertaining to this course are maintained in a secure location by the instructor of record. All records such as exams, answer sheets (with keys), and written papers submitted during the duration of the course are kept for at least one calendar year after course completion. Course work completed via the Blackboard online system, including grading information and comments, is also stored in a safe electronic environment for one year. Students have the right to view their individual record; however, information about student's records will not be divulged to other individuals without proper written consent. Students are encouraged to review the Public Information Policy and the Family Educational Rights and Privacy Act (FERPA) laws and the University's policy. See UNT Policy 10.10, Records Management and Retention for additional information.

Acceptable Student Behavior. Student behavior that interferes with an instructor's ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Dean of Students to consider whether the student's conduct violated the Code of Student Conduct. The University's expectations for student conduct apply to all instructional forums, including University and electronic classroom, labs, discussion groups, field trips, etc. Visit UNT's [Code of Student Conduct](https://deanofstudents.unt.edu/conduct) (<https://deanofstudents.unt.edu/conduct>) to learn more.

Access to Information - Eagle Connect. Students' access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a student's Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward email [Eagle Connect](https://it.unt.edu/eagleconnect) (<https://it.unt.edu/eagleconnect>).

Student Evaluation. Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. The survey will be made available during weeks 13, 14 and 15 of the long semesters to provide students with an opportunity to evaluate how this course is taught. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Students should look for the email in their UNT email inbox. Simply click on the link and complete the survey. Once students complete the survey they will receive a confirmation email that the survey has been submitted. For additional information, please visit the [SPOT website](http://spot.unt.edu/) (<http://spot.unt.edu/>) or email spot@unt.edu.

Important Notice for F-1 Students taking Distance Education Courses

Federal Regulation. To read detailed Immigration and Customs Enforcement regulations for F-1 students taking online courses, please go to the [Electronic Code of Federal Regulations website](http://www.ecfr.gov/) (<http://www.ecfr.gov/>). The specific portion concerning distance education courses is located at Title 8 CFR 214.2 Paragraph (f)(6)(i)(G).

The paragraph reads:

(G) For F-1 students enrolled in classes for credit or classroom hours, no more than the equivalent of one class or three credits per session, term, semester, trimester, or quarter may be counted toward the full course of study requirement if the class is taken online or through distance education and does not require the student's physical attendance for classes, examination or other purposes integral to completion of the class. An online or distance education course is a course that is offered principally through the use of television, audio, or computer transmission including open broadcast, closed circuit, cable, microwave, or satellite, audio conferencing, or computer conferencing. If the F-1 student's course of study is in a language study program, no online or distance education classes may be considered to count toward a student's full course of study requirement.

University of North Texas Compliance. To comply with immigration regulations, an F-1 visa holder within the United States may need to engage in an on-campus experiential component for this course. This component (which must be approved in advance by the instructor) can include activities such as taking an on-campus exam, participating in an on-campus lecture or lab activity, or other on-campus experience integral to the completion of this course.

If such an on-campus activity is required, it is the student's responsibility to do the following:

- (1) Submit a written request to the instructor for an on-campus experiential component within one week of the start of the course.
- (2) Ensure that the activity on campus takes place and the instructor documents it in writing with a notice sent to the International Student and Scholar Services Office. ISSS has a form available that you may use for this purpose.

Because the decision may have serious immigration consequences, if an F-1 student is unsure about his or her need to participate in an on-campus experiential component for this course, s/he

should contact the UNT International Student and Scholar Services Office (telephone 940-565-2195 or email internationaladvising@unt.edu) to get clarification before the one-week deadline.

Student Verification. UNT takes measures to protect the integrity of educational credentials awarded to students enrolled in distance education courses by verifying student identity, protecting student privacy, and notifying students of any special meeting times/locations or additional charges associated with student identity verification in distance education courses.

See [UNT Policy 07-002 Student Identity Verification, Privacy, and Notification and Distance Education Courses](https://policy.unt.edu/policy/07-002) (<https://policy.unt.edu/policy/07-002>).