BMEN 3321 – Biomaterials

Spring 2026

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:**

- 3/4/26: Midterm Exam (during class time)
- 3/9/26: Spring break (no class)
- 3/11/26: Spring break (no class)
- 3/25/26: Poster Due
- 4/20/26: Presentations + abstracts (groups 1-5)
- 4/22/26: Presentations + abstracts (groups 6-10)
- 4/27/26: Presentations + abstracts (groups 11-14)
- 5/02/26: Final Exam (Saturday 7:30-9:30 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%

<u>Class Policies:</u>

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 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: Generative AI tools (such as ChatGPT, Gemini, or similar platforms) may **not** be used to generate content for written assignments, including reflection boards, quizzes, and homework. Submitting AI-generated content as your own work will result in a **zero grade** for the assignment and may be treated as academic misconduct.

This course emphasizes the development of **critical thinking and problem-solving skills**. These skills cannot be learned if generative AI is used to complete your work in place of your own reasoning and analysis.

Limited use of AI for **grammar, spelling, or clarity support only** (similar to Grammarly) is permitted, provided that all ideas, reasoning, and conclusions are entirely your own and that AI use is **fully disclosed** as outlined in the course AI disclosure policy.

Submissions may be reviewed using AI-detection tools as part of the academic integrity process.

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.

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.