

## BMEN 4212 — Senior Design I

Fall 2026 | Biomedical Engineering Department | University of North Texas

### Course Information

- **Instructor:** Xiaodan Shi, [Xiaodan.Shi@unt.edu](mailto:Xiaodan.Shi@unt.edu), office hours Thursday 2-4 pm, DP-K240J
- **Co-instructor:** Neil Chinn, [CorneliusChinn@my.unt.edu](mailto:CorneliusChinn@my.unt.edu), office hours [TBD], DP-E215J
- **Teaching assistant:** Mackenzie Moore, [MackenzieMoore4@my.unt.edu](mailto:MackenzieMoore4@my.unt.edu), office hours & location [TBD]
- **Lecture:** Friday, 9:35-11:25 am, DP-K120
- **Laboratory:** Section 301, Monday 6:30-9:20 pm  
Section 303, Wednesday 3:30-6:20 pm  
Section 304, Friday 3:30-6:20 pm
- **Textbook:** None

### Course Description

- Team biomedical engineering design project involving the development of a problem statement, alternative approaches for a solution, product portfolio, specific system analysis, and design.
- **Prerequisites:** BMEN 3310, BMEN 3350, BMEN 3311, BMEN 3312, BMEN 3321; senior classification.

### Course Objectives

Upon successful completion of this course, students will be able to:

1. Define a significant biomedical need using literature and the voice of the customer.
2. Translate user needs into measurable requirements with verification methods and quantified acceptance criteria.
3. Generate alternatives, justify concept selection with a decision matrix, and represent the design at system and detail levels with requirement traceability.
4. Use engineering analysis or simulation to assess critical requirements, with stated assumptions and limitations.
5. Assess safety and technical risk, constraints, projected cost, and the ethical and professional implications of the design.
6. Plan and manage a two-semester team project and communicate the design to technical and non-technical audiences.

### Brief List of Topics to Cover

- Biomedical needs and requirements; concept generation, selection, representation, and analysis; risk, standards, constraints, ethics, project management, teamwork, and technical communication.

### ABET Student Outcomes and Assessment Map

| ABET student outcome                                                                                                                                                                                                                      | Assessed in this course by                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Outcome 1</b> — Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.                                                                                | Weekly Assignments (Week 6 requirements and verification; Week 10 block diagram and detailed design view; Week 11 engineering analysis and simulation), 2nd Progress Presentation, Technical Proposal.                      |
| <b>Outcome 2</b> — Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. | Weekly Assignments (Week 9 design decision matrix; Week 12 risk assessment, constraints, and mitigations), 2nd Progress Presentation, Technical Proposal (design alternatives, applicable standards, risk, projected cost). |
| <b>Outcome 3</b> — Ability to communicate effectively with a range of audiences.                                                                                                                                                          | 1st and 2nd Progress Presentations, Up-Goer Challenge (Week 14), Elevator Pitch, Technical Proposal.                                                                                                                        |

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| ABET student outcome                                                                                                                                                                                                                                        | Assessed in this course by                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Outcome 4</b> — Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. | Weekly Assignments (Week 5 significance and current solutions; Week 7 informed ethical judgments), Technical Proposal (project scope and design decision rationale). |
| <b>Outcome 5</b> — Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.                                                 | Final Team Member Evaluation (confidential peer evaluation), Faculty Advisor and Sponsor Feedback, weekly meeting minutes with named action items.                   |

### Major Assignments and Grading Policy

|                                                                                                 |                         |
|-------------------------------------------------------------------------------------------------|-------------------------|
| <b>Attendance</b> — 5% ( <i>individual</i> )                                                    | <b>A</b> 89.50 – 100%   |
| <b>Lab Assignments</b> — 10% ( <i>individual</i> )                                              | <b>B</b> 79.50 – 89.49% |
| <b>Weekly Assignments</b> — 15% ( <i>team — peer factor applies</i> )                           | <b>C</b> 69.50 – 79.49% |
| <b>Elevator Pitch</b> — 20% ( <i>team — peer factor applies</i> )                               | <b>D</b> 59.50 – 69.49% |
| <b>Technical Proposal</b> — 25% ( <i>team — peer factor applies</i> )                           | <b>F</b> ≤ 59.49%       |
| <b>Two Progress Presentations</b> — 15% ( <i>team — peer factor applies</i> )                   |                         |
| <b>Faculty Advisor / Sponsor Feedback</b> — 7% ( <i>teamwork, team score</i> )                  |                         |
| <b>Two Peer Evaluations</b> — 3% ( <i>individual, completion-based: 1% midterm + 2% final</i> ) |                         |

### Team deliverables and the individual peer factor

- Team assignments receive one team score. The confidential final peer evaluation determines each student's score: individual score = team score × peer factor.
- The factor equals the student's average peer rating divided by the higher of the team mean or median, capped at 0.80-1.05; meeting expectations normally yields 1.00. The midterm is feedback only. Failure to submit the final evaluation may lower, but cannot raise, the factor. The instructional team reviews all factors and may adjust one when documented evidence warrants; a worked example is on Canvas.
- The factor applies only to Weekly Assignments, Elevator Pitch, Technical Proposal, and two Progress Presentations.
- Faculty Advisor / Sponsor Feedback. Advisor and sponsor ratings are weighted 50/50; for an unsponsored project, the advisor carries the full 7%. The team normally receives one score.

### Senior Design Expectations

- **Two-semester sequence.** Senior Design I produces a conceptual design, engineering analysis or simulation, and a spring verification-and-validation plan; Senior Design II builds and evaluates the design. A deliberately scoped minimal build may succeed when documented in advance; an unplanned schedule-driven reduction is incomplete.

*Date scope changes in the Requirements Revision Log. Reductions through March 14 carry no penalty; later reductions require instructional-team approval for circumstances outside the team's control.*

- **Project standard.** The project must include a biomedical need, verifiable requirements, defensible alternatives, justified selection, and engineering analysis. Characterization, replication, or a literature review is not sufficient on its own.
- **Team responsibility.** The team owns its engineering decisions and records requirement changes in the Revision Log. Plan for approximately 3–5 hours per student each week outside class and lab.

### Project Resources and Compliance

- **Funding, purchasing, and hardware.** Confirm the available budget and ordering process before selecting a design that depends on purchased parts.
- **Intellectual property and confidentiality.** UNT Policy 08.003 and applicable written agreements govern ownership. Students may not independently promise or assign rights, negotiate or sign confidentiality or intellectual-property terms, or accept publication restrictions. Send any such request to the instructional team before sharing confidential information or beginning covered work.
- **Human participants, animals, and biological materials.** Before recruiting or interacting with people or using identifiable private information or biospecimens, notify the instructional team and obtain a written RIC determination. If RIC identifies human-subjects research, complete IRB approval, training, and protocol conditions before recruitment or data collection. Do not assume course-only status; disclose planned public use. IACUC and IBC approval are required for covered animal and biological work. Notify the instructional team by Friday, October 9 if external review may apply, and report its status and a contingency in the fall V&V plan.

### Teamwork and Performance Concerns

- Confidential peer evaluations address equitable contribution, reliability, receptiveness to feedback, initiative, respectful disagreement, and schedule awareness; Canvas defines each criterion.
- Address concerns within the team and document them in the minutes; if unresolved, any member may contact the instructional team. Grade-affecting concerns are due by Week 12 and cannot first appear in the final peer evaluation. Support may include facilitation, a performance agreement, reassigned scope, or a peer-factor adjustment.
- Peer evaluations are individual and confidential; do not coordinate ratings or pressure another student.

### Course Policy

- **Communication.** Check UNT email, Canvas announcements, and the course calendar regularly. Email is appropriate for brief questions; use office hours for questions requiring discussion. Weekday email responses are normally sent within 24 hours.
- **Attendance.** Arrival more than 30 minutes after class begins is recorded as an absence. For an emergency absence, submit official documentation from a UNT email account before class or within 48 hours afterward; documentation submitted at the end of the semester cannot be applied retroactively. See UNT Policy 06.039.

*Each student receives one automatic “absence pass” per semester for the first unexcused absence or late arrival in a regular lecture; it does not apply to presentations. Recording attendance for another student is an academic-integrity violation and results in a zero for the attendance grade for both students, together with a university report.*

- **Late work.** Weekly assignments, presentation drafts, and lab assignments lose 1% per hour late, up to three days, after which they are not accepted. Final presentation slides lose 1% per hour and are not accepted once that session begins. The Technical Proposal loses 5% per 12 hours, capped at 30%, and is not accepted more than three days late. For team submissions, the penalty applies to the team, and a missed presentation (no show on presentation days) without a UNT-approved absence receives zero.

*Each team receives two automatic “late passes” per semester for its first two weekly assignments submitted no more than 24 hours late. A pass waives the penalty; it does not change the deadline.*

### Lab Policy

- Students may use the teaching laboratories without a TA present after completing the required training. Access may be revoked for unsafe conduct, misuse of equipment, or damage to BMEN property.
- Participate in assigned laboratory activities and work collaboratively throughout the scheduled session.
- Complete the required safety and equipment training before using 3D printers, soldering stations, shop tools, or other restricted equipment.

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- Follow the policies of any faculty or sponsor laboratory used for the project; the laboratory owner may revoke access for noncompliance.

### **UNT Academic Integrity Policy**

- 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.
- Generative-AI tools may be used for brainstorming and limited editing, such as grammar, spelling, punctuation, formatting, or similar support. However, they must not produce the substance of engineering work. The analysis, design decisions, conclusions, and other technical work must be the team's own.
- For writing assignments, a Turnitin similarity score above 10% (excluding bibliographic materials) will prompt a review and further a conversation with the team. If a Turnitin AI-writing score is elevated, the team may be asked to provide relevant original drafts, version history, notes, or other documentation of its writing and design process. These materials may be used as supporting evidence to help assess the extent of the team's independent work. Grade consequences follow only from confirmed misconduct under UNT Policy 06.003.

### **UNT ADA Policy**

- UNT makes reasonable academic accommodations for students with disabilities. Students seeking accommodation must first register with the Office of Disability Access (ODA) to verify eligibility. If a disability is verified, the ODA will provide an accommodation letter to be delivered to faculty to begin a private discussion regarding 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 delay in implementation. Students must obtain a new letter of accommodation every semester and meet with each faculty member before implementation in each class. For additional information, see <https://disability.unt.edu/>.

### **Course Safety Procedures (Laboratory Sections)**

- While working in laboratory sessions, students enrolled in BMEN 4212 are required to follow proper safety procedures and guidelines in all activities requiring lifting, climbing, walking on slippery surfaces, using equipment and tools, handling chemical solutions, and handling hot and cold products. Students should be aware that UNT is not liable for injuries incurred while participating in class activities. All students are encouraged to secure adequate insurance coverage in the event of accidental injury. Students who do not have insurance coverage should consider obtaining Student Health Insurance. Students who are injured during class activities may seek medical attention at the Student Health and Wellness Center at reduced rates. If students have an insurance plan other than Student Health Insurance at UNT, they should confirm that the plan covers treatment at this facility. If students choose not to go to the UNT Student Health and Wellness Center, they may be transported to an emergency room at a local hospital, and are responsible for expenses incurred there.

### **Emergency Notification and Procedures**

- UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (severe weather, campus closing, and health and public safety emergencies such as chemical spills, fires, or violence). In the event of university closure, please refer to the UNT learning management system for contingency plans for covering course materials.

### **Prohibition of Discrimination, Harassment, and Retaliation**

- The University of North Texas (UNT) 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. (UNT Policy 16.004)

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### Tentative Schedule

The schedule is tentative and may change in any way to best serve the course objectives.

| Week      | Tentative topic schedule                                                 | Tentative assignments schedule                                          | Tentative lab schedule                 |
|-----------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------|
| 1, 8/21   | Welcome back, and what is expected                                       | Week 1: Your proposal and track — due 8/23                              | No labs in the first week              |
| 2, 8/28   | Project pitch from sponsors                                              | Week 2: Teamwork and Communication training — due 8/30                  | Reference managers and finding sources |
| 3, 9/4    | Student project pitch and experience share; meeting minutes; Gantt chart |                                                                         | Logo design                            |
| 4, 9/11   | Systems engineering and population of interest                           | Week 4: Team info and charter — due 9/13                                | CAD / SolidWorks refresher             |
| 5, 9/18   | Intended use, requirements, deliverables, and impacts                    | Week 5: Significance and gap — due 9/20                                 | CAD / SolidWorks refresher             |
| 6, 9/25   | Design decision matrix; roundtable with past seniors                     | Week 6: VOC, requirements, V/V — due 9/27                               | Electronics and Arduino refresher      |
| 7, 10/2   | 1st Progress Presentation prep                                           | Week 7: Impacts and informed judgments; 1st PP draft — due 10/4         | COMSOL and computations                |
| 8, 10/9   | 1st Progress Presentation (need, background, significance, requirements) | Week 8: Meeting minutes; final presentation slides — due 10/8           | Presentation rehearsal                 |
| 9, 10/16  | Design matrix refresher; block diagram seminar                           | Week 9: Design decision matrix and Gantt chart skeleton — due 10/18     | COMSOL and computations                |
| 10, 10/23 | Risks, constraints, and applicable standards (Professor Holliday)        | Week 10: Block diagram and one detailed design view — due 10/25         | 3D printing training (FDM)             |
| 11, 10/30 | Workshop (technical writing or career center)                            | Week 11: One engineering analysis and/or simulation — due 11/1          | Soldering                              |
| 12, 11/6  | 2nd Progress Presentation prep                                           | Week 12: Risks, constraints, mitigations; 2nd PP draft — due 11/8       | 3D printing training (SLA)             |
| 13, 11/13 | 2nd Progress Presentation (conceptual design)                            | Week 13: Meeting minutes due Sun; final presentation slides — due 11/12 | 2nd PP rehearsal; writing workshop     |
| 14, 11/20 | Up-Goer Challenge (in class)                                             | Week 14: Up-Goer slides — due Thu 11/19; meeting minutes — due 11/22    | Pitch practice; writing workshop       |
| 15, 11/27 | Thanksgiving holiday — no class                                          | Week 15: Two-semester Gantt chart at task level — due 11/29             | No labs this week                      |
| 16, 12/4  | Reading day — no class                                                   | Elevator pitch draft; Technical Proposal — due 12/6                     | Pitch practice; writing workshop       |
| 17, 12/9  | Elevator Pitch, 8:00–10:30 am                                            | Final pitch slides — due Tue 12/8, 11:59 pm                             | No labs; optional pitch practice       |