# Faculty of Engineering and Natural Sciences
# BIOENGINEERING
# BIO444 and BIO544
# Fall 2022

**Instructor:** Nur Mustafaoglu
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**TAs:**

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- Gulin Baran, Email: gulinbaran@sabanciuniv.edu

**Course Date and Address:**

| | | | |
|---|---|---|---|
| 9:40 am – 10:30 am | Wednesday | FENS | **L062** |
| 12:40 pm – 14:30 pm | Thursday | FENS | **L030** |

**Office Hours:** by appointment!
Please make sure to schedule an appointment with the instructor and/or TAs prior the meeting.

**Objectives:**
The Bioengineering course provides a solid foundation in engineering design and the natural and biological sciences. The course is designed to acquaint students with current research and problems in bioengineering by introducing them to the application of engineering principles to biological and medical problems. It provides students with an understanding of the breadth of bioengineering and the knowledge and skills required to contribute to the development of the rapidly growing field of bioengineering. The course introduces the fundamentals of bioengineering, provides information on cell and tissue engineering and stem cell technologies, introduces biomechanics and mechanobiological aspects, and explains the biological performance of materials. Applications of bioengineering are then explored, particularly for biosensors and diagnostic systems, therapeutic approaches, and drug delivery technologies, followed by applications in various disciplines, including but not limited to genetics, chemical engineering, computer science, electrical engineering, and environmental engineering.

**Learning Outcomes:**
A student who successfully fulfills the course requirements will be able to demonstrate:

1) Understand the definition of bioengineering and its difference from biomedical engineering
2) Employs engineering to the life sciences, particularly to biology
3) Understand the foundation for engineering biology
4) Identify applications of bioengineering in different disciplines including chemical engineering, mechanical engineering, computer science, electrical engineering, and civil and environmental engineering
5) Analyze a given theoretical problem/case, identify gaps in knowledge and retrieve knowledge from relevant scientific literature
6) Give an account for basic and advanced bioengineering techniques
7) Identify and apply a suitable method theoretically or practically to address the research question at hand
8) Compile and present a literature study and develop an ability to critically analyze and discuss science by reviewing texts in public and scientific papers
9) Identify and discuss ethical issues related to scientific activities.

**Course Materials:**

- Review articles
- Research articles
- Some additional reading materials and videos will be shared on SuCourse

**Weekly Plan**

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|---|---|---|---|
| Week 1 | 05/10/2022<br>06/10/2022 | Meeting and course introduction | |
| Week 2 | 12/10/2022<br>13/10/2022 | What is bioengineering? | Group Declarations for project design and presentation |
| Week 3 | 19/10/2022<br>20/10/2022 | Cell and tissue engineering | |
| Week 4 | 26/10/2022<br>27/10/2022 | Cell and tissue engineering | Submit project title and abstract |
| Week 5 | 02/11/2022<br>03/11/2022 | Stem cells and technologies | |
| Week 6 | 09/11/2022<br>10/11/2022 | No class<br>**Midterm-I** | Declare presentation focus |
| Week 7 | 16/11/2022<br>17/11/2022 | Biomechanics: analysis and design | |
| Week 8 | 23/11/2022<br>24/11/2022 | Molecular biomechanics and mechanobiology of the cell | |
| Week 9 | 30/11/2022<br>01/12/2022 | Biological performance of materials | |
| Week 10 | 07/12/2022<br>08/12/2022 | Bioengineering applications for diagnostic and therapeutic approaches | |
| Week 11 | 14/12/2022<br>15/12/2022 | | |
| Week 12 | 21/12/2022<br>22/12/2022 | No class<br>**Midterm-I** | |
| Week 13 | 28/12/2022<br>29/12/2022 | *Student Presentations* | |
| Week 14 | 04/01/2023<br>05/01/2023<br>06/01/2023 | *Student Presentations* | Project Submission |

**Grading Policy:**

**Homework 20%:** There will be 4-5 homework assignments throughout semester
- Homework due dates will be announced for each homework.
- Late assignments: 10% late penalty will be implemented for up to 3 days. Homework summited 3 days later than the due date will not be accepted; students' grade will be 0 for that assignment.

**Midterms (2x20%):** There will be two midterms:
**Midterm-I:** Students will be responsible for the material of week 1-5
**Midterm-II:** Students will be responsible for the material of week 7-11

**Project (25%):**
- Students will design a bioengineering project based on their own interest
- Students will establish a project group (1-4 people in each group)
  Important! Last day of declaring a group will be **13/10/2022**.
- The groups should declare their project topics and submit their project's title and abstract by **27/10/2022**.
- Projects must be written in TUBITAK 1002 format (in English) and submitted by the **06/01/2023**.
- Each group may request two meetings about their projects with TAs and/or the instructor.
- Grading of the presentations (25 pts):
  - Project concept and design: 10 pts
  - Writing: 10 pts
  - Video (max 10 min): 5 pts
  - Bonus – meetings with TAs/Instructor: 3 pts

**Presentations (15%):**
- Presentations on the "Bioengineering Applications in different disciplines" will be performed as groups of 2-5 students.
  - Important! Last day of declaring a group will be **13/10/2022**.

        - Groups should present a research paper (or papers) about a specific bioengineering application in a discipline below.
            - Molecular Biology
            - Genetics
            - Chemical Engineering
            - Computer Science
            - Electrical Engineering
            - Material Science
            - Nano Science
            - Civil Engineering
            - Environmental Engineering
        - Groups should declare their focus discipline by **10/11/2022**.
    - Important! Each group should send their presentation materials (slides) to the lecturer a day before the presentation by midnight.
        - 1/3 of the presentation grade is the presentation material.
        - Please do not forget to send it to the instructor on time!
    - Grading of the presentations (15 pts):
        - Presentation materials (slides): 5 pts
        - Presentation (explaining the concepts): 5 pts
        - Answering questions: 5 pts

| Highest | Lowest | Letter |
|---|---|---|
| 100.00 % | 93.00 % | A |
| 92.99 % | 87.00 % | A- |
| 86.99 % | 83.00 % | B+ |
| 82.99 % | 77.00 % | B |
| 76.99 % | 73.00 % | B- |
| 72.99 % | 67.00 % | C+ |
| 66.99 % | 63.00 % | C |
| 62.99 % | 57.00 % | C- |
| 56.99 % | 53.00 % | D+ |
| 52.99 % | 50.00 % | D |
| 49.99 % | 0.00 % | F |

**Exam Policy:**

- Exams may include multiple choice, fill-in-the-blank, problem solving, or short answers.
- All exams will be closed book and held in class.
- For exams you will only require a pencil and a calculator.
- Phones are not allowed and must be turned off.
- If you leave during an exam, you will not be allowed back in
- Late arriving students will not be allowed after the first student finishes the exam and leaves.

**Grade disputes**

- Students will have one week after the return of an exam or an assignment to challenge a grade for any question with a written note providing an explanation.
- Failure to challenge the grade within this period indicates a willingness to accept the grade as is.
- The challenge should consist of a written description of why the answer is correct based on other published material that you cite.

**Academic Honesty:**

- All students must follow the university guidelines of academic integrity. https://www.sabanciuniv.edu/en/academic-integrity-statement
- A strict zero-tolerance policy for cheating will be enforced.