

BIOMECHANICS (BIE 3134)

Manisa Celal Bayar University - Department of Bioengineering
Spring 2024

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Course Time:

Monday 14:25

Course Credit:

3,00(Theo) : 5,00(ECTS)

Course Room:

C-204 (Engineering)

Office Hours:

After class or by appointment via email or Microsoft Teams.You may visit me at any time during the week days if I am available.

Textbook:

Not a specific book is suggested. A large number of books on biomechanics/mechanics are available. Following books are recommended.

- Özkaya, N., Nordin, M. , Goldsheyder, D., Leger, D., Fundamentals of Biomechanics : Equilibrium, Motion, and Deformation, Springer New York, 2014.
- Peterson,D.R., Bronzino,J.D. Biomechanics: Principles and Applications, CRC Press 2008.
- Oomens,C., Brekelmans,M., Baaijens,F., Biomechanics: Concepts and Computation, Cambridge University Press, 2009.
- Knudson,D., Fundamentals of Biomechanics, Springer, 2007.
- Ethier,C.R., Simmons,C.A., Introductory Biomechanics: From Cells to Organisms, Cambridge University Press, 2007.

Fundamental books of mechanics

- Hibbeler,R.C., Engineering Mechanics: Statics, Pearson, 2015.
- Hibbeler,R.C., Engineering Mechanics: Dynamics, Pearson, 2017.
- Beer,F.B.,Johnston,E.R., DeWolf,J.T., Mazurek,D.F., Mechanics of Materials, McGraw Hill, 2015.
- Çengel,Y., Cimbala,J.M., Fluid Mechanics Fundamentals and Applications, McGraw Hill, 2017.

Course Information:

Biomechanics is an area of study wherein the knowledge and methods of mechanics are applied to the structure and function of the living systems. The course includes a combination of knowledge both biological and material properties of living tissues. It provides an overview of basic mechanics, anatomy, mechanical properties and structural behaviors of biological tissues. The objectives of the course include:

- To provide fundamental concepts of mechanics in order to facilitate further study in biomechanics.
- To give an understanding of the mechanical and anatomical principles that govern human motion and develop the ability to link the structure of the human body with its functions from a mechanical perspective.
- To make the students familiar with the methods for characterization of the musculoskeletal system, based on basic mechanics concepts.
- To understand behaviour of biomaterials (soft and hard tissues) by using mathematical and physical principles.

Course Outcomes:

By the end of this course, students will be able to:

- Analyze basic mechanics (statics, dynamics and strength of materials) problems in biomechanics.
- Analyze basic fluid mechanics problems in biomechanics.
- Describe how mechanics plays a role in basic physiological processes of the living tissues.
- Use the abilities gained from fundamental mechanics for understanding the behaviors of the living systems.
- Identify bones, ligaments or muscles by name, anatomic location, or function.

Prerequisites:

- An undergraduate-level understanding of physics, biology, engineering mechanics and mathematics (calculus) is assumed.
- Motivation to learn.

Tentative Course Outline:

- Week 1 :Preliminaries, Introduction to Mechanics Science.
- Week 2 :Basic Concepts of Mechanics, Dimensions, Scalars and Vectors.
- Week 3 :Concepts of Statics, Newton's Laws, Structures.
- Week 4 :Statics and Biomechanics, Mechanics of Muskuloskeletal Parts.
- Week 5 :Concepts of Dynamics, Kinematics, Kinetics, Work, Energy, Momentum.
- Week 6 :Dynamics and Biomechanics Applications.
- Week 7 :Mechanics of Materials, Stress and Strain, Deformations.
- Week 8 :Mechanics of Living Tissues, Elasticity and Viscoelasticity.
- Week 9 :Biomechanics of Soft Tissues.
- Week 10 :Biomechanics of Hard Tissues.
- Week 11 :Fluid Mechanics, Basic Concepts, Biofluids.
- Week 12 :Special Topics 1, Class Discussions.
- Week 13 :Special Topics 2, Class Discussions.
- Week 14 :Special Topics 3, Class Discussions.

Grading Policy:

Midterm (35%), Group Project (15%), Final (50%).

Important Dates:

Midterm Exam to be announced.
Project Deadline to be announced.
Final Exam to be announced.

Course Policy:

Every student is expected to come to class prepared and to actively participate in learning environment.

Class Policy:

Regular attendance is essential and expected.

Academic Honesty:

Lack of knowledge of academic honesty is not a reasonable explanation for a violation.