BE3310 and BE5310 Biomechanics, Fluid Flow and Computational Lab
Spring 2018

Time T/TH 3:30 - 4:50 p.m. **Room** SH 125 **Computer Lab** ERB 280

Instructor Dr. Juhyun Lee

TA Nabid Salehin **TA hours:** T/TH 1:00 – 3:00 p.m. at ERB 280

Goals

- To understand the basic force-deformation relationship and how stresses are developed in a physical object (including living things) when under applied loads
- To study the deformation and resulting motion experienced by living things in response to applied loads
- To understand the meanings of stress, strain, strain rate, and the relations tie them together in the context of bio-solid and bio-fluid
- To learn how to describe the mechanical properties of bio-solid and bio-fluid
    - Stress-strain relationship (example - Hooks law),
    - Stress-shear rate relationship (example - Newtonian fluid)
- To understand the concept of equilibrium (equation of equilibrium, equation of motion)
- To understand biomechanical proprieties description of living things and their relevance in physiological processes and functions at tissue, organ, or organismal levels
- To learn the basics of finite element modeling technique and its applications in the study bioengineering and biomedical engineering problems, including the design of medical devices.

Prerequisites Undergraduate general physics part 1, 2 (topics of statics/dynamics, strength of materials, introductory solid mechanics and fluid mechanics)

Course contents - topics to be covered

Lecture
1. A review of basic math
2. Rigid body kinematics, Static equilibrium.
3. Vector Calculus, Tensor notation
4. Mapping, Coordinate transformation
5. Strain, Deformation
6. Stress
7. Constitutive Laws
8. Introduction to fluid mechanics
9. Couette flow, Hagen-Poiseuille flow
10. Navier-Stokes equation

Lab
1. Using SolidWorks to build 3D geometry of component parts
2. Using COMSOL for stress analysis (analysis of blood vessels under loadings)

Homework: Due at beginning of lecture on specified day.

Late Homework
There will be penalty for late submission calculated as 10% for every one hour.

Textbook: The books listed below are not required for the course, but they will be useful references and I will provide optional reading assignments from them.

Continuum Mechanics by A.J.M. Spencer
https://www.amazon.com/Continuum-Mechanics-Dover-Books-Physics/dp/0486435946

Grading
Midterm 1 20%
Midterm 2 20%
Final 20%
Homework 15%
Lab homework 10%
Project presentation 10%
Participation 5%

Americans with Disabilities Act:
The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the Americans with Disabilities Act (ADA). All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364. If you require an accommodation based on disability, I would like to meet with you in the privacy of my office, during the first week of the semester, to make sure you are appropriately accommodated.

Academic Integrity and Academic Dishonesty:
It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University. According to the UT System Regents' Rule 50101, §2.2, "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts."