**Course Description**

The course is an introduction to the fundamental engineering science of transport phenomena, with applications in living systems. Lectures will focus on using conservation equations at the microscopic level to derive expressions that can then be used to describe momentum, energy and mass transport for particular problems. Additional problems will be recommended for students to complete outside of class, with follow-up quizzes relevant to the concepts learned.

**Course Goal**

The goal of the course is to introduce the student to momentum, energy and mass transport, emphasizing the analogies that exist among the three and the relevance of the phenomena to physiology and biomedical engineering.

**Learning Outcomes**

Those students who participate fully in the course will be able to:

- Describe the constitutive equations that define fluid viscosity (momentum transport), thermal conductivity (heat transport), and molecular diffusivity (mass transport).
- Set-up shell balances for the conservation of momentum, energy or mass transport for laminar flow. Derive the governing differential equations describing a particular problem. Apply boundary conditions to solve the equations. Interpret the behavior described by the solution.
- Use the full equations of change for momentum, energy or mass transport to describe a particular problem. Apply boundary conditions to solve the equations. Interpret the behavior described by the solution.
- Apply the methods from above to problems of relevance in biomedical engineering, e.g. blood rheology and circulatory flow, oxygen transport to tissue, drug transport in tumors, controlled drug delivery.
**Listed Prerequisites**
- MA 226 (Differential Equations)
- PY 211 (Physics I)

**Expected Prerequisite**
- EK 301 (Engineering Mechanics I)

**Course Materials**
The textbook for the course is *Transport Phenomena (Revised Second Edition)*, RB Bird, WE Stewart and EN Lightfoot, John Wiley and Sons (2007). All readings and problems will be from the book, supplemented by handouts and problems on biomedical applications when and where necessary, uploaded to Blackboard.

**Grading**
Course grades will be based on:
- **Quizzes** (9 total) 20%
- **Exam 1** (October 2) 20%
- **Exam 2** (November 4) 20%
- **Exam 3** (December 9) 20%
- **Final Exam** (December 16 at 3:00 pm) 20%

**Quizzes.** Each quiz will be based on the suggested problems for out-of-class study and will be given at the start of Discussion. The lowest quiz grade will be dropped. If you miss one quiz, it will be the one dropped. If you miss additional quizzes, the score on those quizzes will be 0 and averaged into the overall quiz grade. Tentative dates: 9/13, 9/20, 9/27, 10/18, 10/25, 11/1, 11/15, 11/22, 12/6

**Exams.** The time allotted for each of the four exams will be 70 minutes. The final will be cumulative.

All quizzes and exams are Closed Book/Closed Notes. Equations will be provided if necessary.

*Any suspected violation of the Academic Conduct Code on quizzes and exams will be immediately referred to the College of Engineering Academic Conduct Committee.*
(https://www.bu.edu/academics/policies/academic-conduct-code/)

**Important Dates**
- October 7 – last day to drop course without a W
- November 8 – last day to drop course with a W