CSCE 990 Sec. 006 - Molecular and Nanoscale Communication

Spring 2018, Time: **9:30AM-10:45AM**, Location: **Avery Hall 110**

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Office Hours TBD or by appointment.

Description Develop an understanding of the different options to realize communication at the nanoscale among nano-precise entities, or nanomachines, being they genetically engineered biological cells or man-made nano-devices. The specific focus will be on bio-inspired communication through molecule exchange and biochemical reactions. Different techniques to realize nanomachines will be surveyed in the course, with particular attention to the tools provided by synthetic biology for the programming of biological cooperative systems. This course will give a chance to be initiated to a very exciting cutting-edge research field, which will soon influence many diverse research fields, such as engineering, chemistry, biology, and medicine.

Prerequisites Good standing undergraduate/graduate student from Computer Science and Engineering, Electrical Engineering, Chemical Engineering, Biology, Chemistry, Chemical and Biomolecular Engineering, and Mathematics, or upon instructor permission.

Most of the necessary concepts from physics, chemistry, and biology, as well as from systems and communication engineering, will be provided during the lectures to accommodate students with different backgrounds, and let them benefit from a truly interdisciplinary approach. Student creativity, passion, and open-minded attitude will be highly appreciated and rewarded.

Textbooks **"Fundamentals of Diffusion-Based Molecular Communication in Nanonetworks"**
by Massimiliano Pierobon, Ian F. Akyildiz
Now Publishers Inc (April 30, 2014)
ISBN-10: 1601988168

ISBN-13: 978-1601988164

Selected lectures of this course will be based on the following additional textbooks (not required):

Synthetic Biology — A Primer
by Paul S Freemont and Richard I Kitney

Communication Systems Engineering
by John G. Proakis and Masoud Salehi

Lecture slides (PDF) will be available on the course's homepage.

A list of reference books and research papers will be given throughout the semester.

Some of the research papers and reports will be distributed via the course's homepage.
HOMEWORKS and EXAMS will be based on what explained during the lectures and supplemental reading materials.

Course Topics

0. Course Presentation
1. Overview of Molecular and Nanoscale Communications: from Motivation to Applications
2. Introduction to Molecular Communication Theory
3. Analysis of Molecular Communication Systems
4. Molecular Communication and Biochemical Pathways
5. Molecular Communication and Electrochemistry
6. Design/Engineering of Molecular Communication Systems
7. Molecular Communication and Neurons
8. Molecular Communication and Synthetic Biology
9. Towards the Internet of Bio-Nano Things

Course Organization

There will be TWO (OPEN NOTES) exams, FOUR homeworks, and ONE TEAM PROJECT assignment.

Grade Distribution

Homeworks: 15%
Lab Assignments: 5%
Exam 1 (OPEN NOTES): 20%
Exam 2 (OPEN NOTES): 20%
Project: 35%
In-class Participation: 5%

Final letter grades will be assigned tentatively based on the following scale:

A+: ≥ 100	A: 97% to 100%	A−: 94% to 96%
B+: 90% to 93%	B: 87% to 89%	B−: 84% to 86%
C+: 80% to 83%	C: 77% to 79%	C−: 74% to 76%
D+: 70% to 73%	D: 67% to 69%	D−: 64% to 66%

F: ≤ 63%

Homeworks

Homework submissions will be through web handin
Late homework is penalized 10% per day, and no homework will be accepted after the solution is posted online

Exams

There will be TWO in-class exams.
All exams are OPEN NOTES.

Project

There will be half-semester-long projects, focused on the design, analysis and presentation to the class (at the end of the semester) of a diffusion-based molecular communication system within the COMSOL Multiphysics environment (or equivalent physical modeling software). The project will be assigned students divided into teams according to the class size.

Academic Integrity

All homework assignments, quizzes, exams, etc. must be your own work. No direct collaboration with fellow students, past or current, is allowed unless otherwise stated. The Computer Science & Engineering department has an **Academic Integrity Policy**:

http://cse.unl.edu/ugrad/resources/academic_integrity.php

All students enrolled in any computer science course are bound by this policy. You are expected to read, understand, and follow this policy. Violations will be dealt with on a case by case basis and may result in a failing assignment or a failing grade for the course itself.

Students with Disabilities

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodations to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 232 Canfield Administration, 472-3787 voice or TTY.

Suggestion Box

The CSE Department has an **anonymous suggestion box**

	(http://cse.unl.edu/department/suggestion.php) that you may use to voice your concerns about any problems in the course or department if you do not wish to be identified.
Stay Up-to-date	It is CSE Department policy that all students in CSE courses are expected to regularly check their email so they do not miss important announcements.
CSE Resource Student Center	The CSE Student Resource Center (Avery Hall Rm 12) is intended to provide UNL Computer Science and Computer Engineering majors who are new to the program with a set of resources that will help them assimilate to college life and encourage them to continue their study of Computer Science and Computer Engineering (http://cse.unl.edu/src).

This syllabus will be updated and expanded as the semester progresses.