CSCE 896/496 - Molecular and Nanoscale Communication

Spring 2016, MWF 9:30AM – 10:20AM
Room 111, Avery Hall

Instructor	Dr. Massimiliano Pierobon Assistant Professor 107 Schorr Center Department of Computer Science and Engineering University of Nebraska-Lincoln Lincoln, NE 68508 Tel: (402) 472-5021 Fax: (402) 472-7767 E-mail: pierobon@cse.unl.edu
Website of Class	http://cse.unl.edu/~pierobon/teaching.html
Office Hours	MW 4:30PM – 5:50PM or by appointment.
Description	The goal of this course is to 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.
Prerequisite	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.
Required Textbook	NO TEXTBOOK REQUIRED.

This course is largely based on the following textbooks

Fundamentals of Diffusion-Based Molecular Communication in Nanonetworks
by Massimiliano Pierobon and Ian F. Akyildiz

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

 Communication Systems Engineering
by John G. Proakis and Masoud Salehi

Introduction to COMSOL Multiphysics
by COMSOL AB
http://www.comsol.com/shared/downloads/IntroductionToCOMSOLMultip hysics.pdf

Lecture slides (PDF) will be available on Blackboard.

A list of reference books and research papers will be given throughout the semester.
Some of the research papers and reports will be available in Blackboard.
HOMEWORKS and EXAMS will be based on what explained during the lectures and supplemental reading materials.

Course Topics	1. Introduction to Nanoscale Communications
	2. Introduction to Communication Systems
	3. Molecular Communication Options at the Nanoscale
	4. Design and Modeling of a Diffusion-based MC System
	5. Noise Analysis in Diffusion-based MC
	6. Performance Analysis
	7. Interference Analysis
	8. MC Systems Realization with Synthetic Biology

| **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%

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. 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, 132 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 13A) 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.