CHE 462 - Colloids and Nanoscale Engineering
Prof. Orlin Velev, Department of Chemical and Biomolecular Engineering, NCSU
http://crystal.che.ncsu.edu/

Synopsis
The CHE 462 course provides students with the basic principles and broad interdisciplinary outlook required for successful practice in the areas of nanotechnology, bioarrays, sensors and microdevices. This course begins with coverage of the fundamentals of colloidal interactions between surfaces, particles, surfactants and biomolecules, and their relevance to self-assembly. The theory and practice of particle characterization by scattering methods and their manipulation by external fields are presented. In the second part of the course, emerging colloid-related technologies in microfluidics, bioarrays, nanoparticles and nanostructured materials are presented. Ways to apply the colloidal fundamentals to the engineering on the nanoscale are discussed.

The emerging field of nanotechnology is attracting interest and large governmental and private investment. In the coming years, the US National Nanotechnology Initiative will develop a broad range of technologies for application of nanomaterials, nanostructures and nanodevices in electronics, biotech and in other emerging industries. Vast areas of application of colloid science are currently being opened by the developing technologies of microfabrication, bioarrays and nanotechnology. Future progress in these areas will require understanding and modification of the molecular and surface interactions. This will allow engineering on the nanoscale similarly to the way process engineering is presently done for larger scale units and operations.

The course will include 19 lectures, 2 experimental laboratory demonstrations, 4 discussions on recent developments in colloids and nanoscience and one discussion on the perspectives and entrepreneurial opportunities in nanotechnology.

Additional details:
Dr. Velev, 513-4318, odvelev@unity.ncsu.edu

Contents
Colloid Science
Surface tension, contact angle, wetting
Surfactants, self-assembly and detergency
Basics of the intermolecular and surface forces
Interactions between biological molecules
Manipulation of colloids and biocolloids with external fields

Nanoscale engineering
Microfluidics and lab-on-a-chip devices - principles and applications
Bioarrays and biosensors - principles
Nanoparticles and nanostructured materials
Microstructures with photonic and electronic functionality

CHE 462, Spring 2009, Tue & Thu, 9:35-10:50