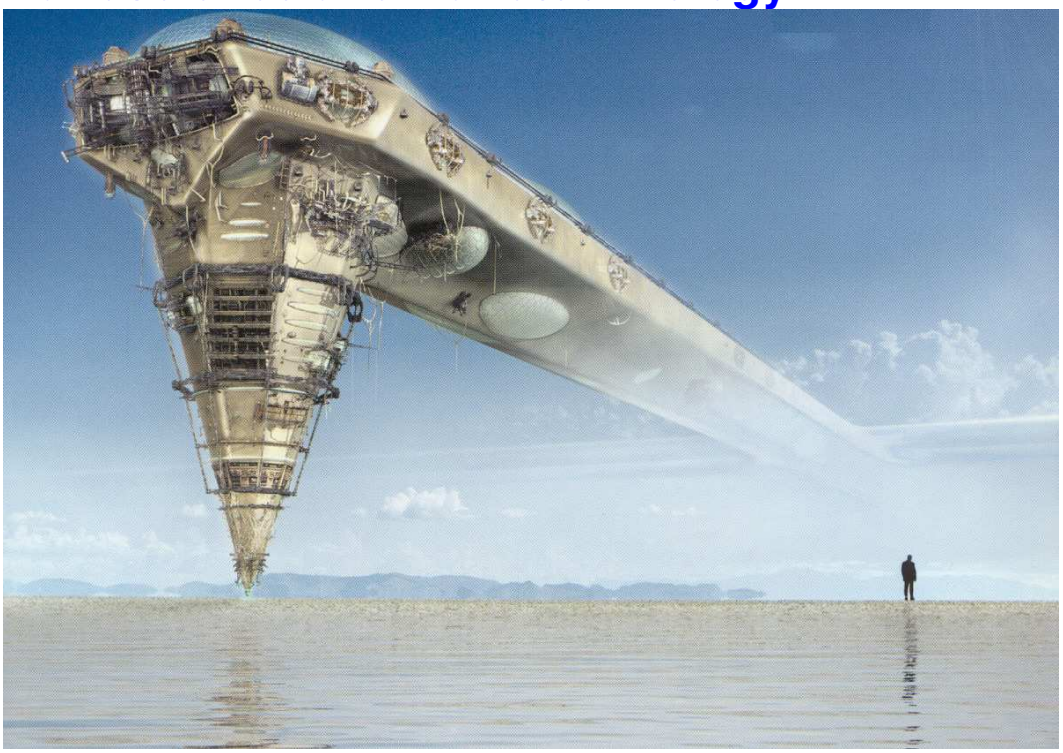
SYLLABUS fall semester 2009

CHEM 6090 - ME 6950
Nanoscience and Nanotechnology



COURSE DESCRIPTION

Nanoscience and Nanotechnology make use of materials and systems at a length scale of few nanometers to few hundred nanometers. Advances in scientific measurement at that scale and the ability to manipulate material at that scale, scientists and engineers have found ever increasing uses for nano-sized metals, semiconductors, polymers, and ceramics to create new functional materials and a host of other applications beneficial to mankind.

This course is aimed at introducing the important concepts and applications of nanoscience and nanotechnology to multidisciplinary audience such as chemists, physics, biologists and engineers. Tools and principles relevant at the nanoscale dimension will be discussed. It also provides an overview of current and future nanotechnology applications in materials, physics, chemistry, biology, electronics, energy and medicine. This course should be suitable for graduate students as well as advanced undergraduates.

COURSE TYPE: 3 credit hours lecture. This course is cross-listed with Chemistry Department (CHEM 6090) and therefore is offered together with Chemistry Department

INSTRUCTORS: **Dr. Ramakrishna Guda (rama.guda@wmich.edu)**
Dr. Valery Bliznyuk (valery.bliznyuk@wmich.edu)

CLASS TIME and PLACE: **Chemistry Bldg 01260 Tuesday and Thursday 6:30 pm - 7:45 pm**

OFFICE HOURS: **Tues, Thurs 3:30-5:00 or by appointment 3444 Wood Hall**
Tues, Thurs 11:00-12:00 or by appointment G247 CE&AS Parkview Bldg

OFFICE PHONES: **269-387-2854 (Dr. Guda); 269-276-3213 (Dr. Bliznyuk)**

TENTATIVE LECTURE SCHEDULE

#Wk.	Dates	Topic
#1,	9/8	Introduction- Overview of nanoscience
	9/10	Theory, definitions and history – properties at nanoscale
#2,	9/15	Societal implications of nanoscience – nanotoxicology
	9/17	Different classes of Nanomaterials – Materials, structure and nanosurface
#3,	9/22	Energy at nanoscale – Surface energy
	9/24	The Material Continuum- Basic quantum mechanics
#4,	9/29	0D, 1D, 2D and 3D nanomaterials
	10/1	Carbon based nanomaterials – Exam Review
#5,	10/6	Synthesis of Nanomaterials
	10/8	**Midterm Exam I**
#6,	10/13	"Top-down" approach: Nanolithography, CVD, MEMS
	10/15	"Wet deposition" techniques (LB, spin-coating, dip-coating)
#7,	10/20	"Bottom up approach" – Sol-gel processing, colloidal. Nanoparticles, organic nanomaterials and self-assembly
	10/22	Structure and properties characterization of nanomaterials (Diffraction techniques, spectroscopy and modeling)

#8,	10/27		Imaging techniques: Scanning and transmission electron microscopy.
	10/29		Scanning probe microscopy techniques – Exam Review
#9,	11/3		Applications of Nanomaterials
	11/5		**Midterm Exam II**
#10,	11/10		Solar energy conversion, storage and catalysis
	11/12		Fluorescence microscopy and Imaging
#11,	11/17		Nanoelectronics
	11/19		Nanosensors
#12,	11/24		Nanomedicine and Nanobiotechnology –Exam review
	11/26		**Thanksgiving, no class**
#13,	**12/1**		**Midterm Exam III**
	12/3		Student Presentations
#14,	12/8		Student Presentations
	12/10		Student Presentations *15 minutes are allocated for each presentation in addition to 5 minutes of questions*
#15,	**12/17**	**-----**	**Final Exam – Term Paper**

TEXTBOOK:
G.L.Hornyak, J.Dutta, H.F.Tibbals, A.K.Rao, Introduction to Nanoscience, CRC Press, 2008, ISBN: 978-1-4200-4805-6

RECOMMENDED LITERATURE:
A.Nabok, *Organic and Inorganic Nanostructures*, Artech House 2005
C.Dupas, P.Houdy, M.Lahmani, *Nanoscience: Nanotechnologies and Nanophysics*, Springer-Verlag Berlin Heidelberg 2007
Hari Singh Nalwa, *Nanostructured Materials and Nanotechnology*, Academic Press, 2002

PREREQUISITE: Graduate level or approval from the instructor

HOME WORK and assignments are suggested at the end of each topic and the due dates are also announced in the class.