

MSN 517: INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY I

This course is the first installment of a two-semester introduction to nanoscience and nanotechnology courses. The course aims to give students a perspective on the physics, physics related applications and device fabrication/characterization at nanoscales.

Instructor: T. Serkan Kasirga

Contact: Office: UNAM 307, Phone: 8026, E-mail: kasirga@unam.bilkent.edu.tr

Course website: <http://serkankasirga.com/teaching/msn517>

Office hours: Thursdays, before the class, by appointment

Lectures: 9:40 Tuesday, 10:40-12:30 Thursday

Assistants: TBA

Grading (tentative)

Midterm I 25%

Midterm II 25%

Project 30%

Quizzes and Homework 20%

Textbooks:

S.M. Lindsay, Introduction to Nanoscience, 2008.

Reference books:

T. Heinzl, Mesoscopic electronics in solid state nanostructures, 2003.

Weekly calendar (Tentative)

	Week	Subject
#1	Sept. 16	Introduction to Nanoscience- History: a route to small scales, Basics: why small?, length scales, wave nature of matter
#2	Sept. 23	Physics at Nanoscales- Working with waves/particles: Quantum mechanics, concepts in quantum mechanics, statistical behavior of particles
#3	Sept. 30	Collective behavior of particles Thermodynamics, interactions at nanoscale: van der Waals, Coulomb etc...
#4	Oct. 7	Atoms in an order 1- Solids: basics of crystals, metals, insulators and semiconductors
#5	Oct. 14	Atoms in an order 2- Playground of modern nanotechnology: 2D materials, transition-metal oxides, heterostructures, computational methods
#6	Oct. 21	Making functional devices out of solids 1- Diode, Laser Diode, Transistors: JFET, MOSFET, BJT, TFT,
#7	Oct. 28	Making functional devices out of solids 2- [Midterm I] HEMT, SET, CMOS logic; Q-dots, nanowires, fibers
#8	Nov. 3	Making functional devices out of solids 3- flash memory, meristor, PCM, CCD, Photonic crystals, nanoparticles, 2D/3D materials
#9	Nov. 10	How to actually make them 1- From sand to wafer: Czochralski method, Bridgman–Stockbarger technique, micro-pulling-down; MOCVD, PECVD, MBE, PLD, ALD, PVD, Lithography: photo, e-beam;
#10	Nov. 17	How to actually make them 2- focused ion beam milling and deposition, e-beam evaporator, sputterer, ICP, ALD
#11	Nov. 23	How to actually make them 3- Etching: wet and chemical etching techniques, DRIE, fiber drawing
#12	Nov. 30	Characterizing your device 1-

#13	Dec. 6	Electronic transport, magnetotransport, chilling things: LN, helium cryostats, dilution fridge, AFM, SEM, TEM, STM Characterizing your device 2- [Midterm II]
#14	May13	Raman spectroscopy, ultrafast pump-probe spectroscopy, FTIR, SNOM, XPS, XRD, NMR Characterizing your device 3- Ellipsometer Outlook

Projects:

Making and Characterizing a Graphene Transistor

Making SERS