

## ESG 281: Engineering Introduction to the Solid State (Fall semester, 2018)

Textbook: 1. Modern Physics for Scientists and Engineers, 2<sup>nd</sup> ed. (2017) by J. R. Taylor and C. D. Zafirators  
2. Fundamentals of Solid State Engineering, 3<sup>rd</sup> ed. (2009) by Manijeh Razeghi

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**Office hours: 4-5 PM on Tuesday and Thursday**

Week	Date	Topics
1	2018/9/4	Quantum physics (Blackbody radiation, Planck hypo., Rutherford exp)
	2018/9/6	Quantum physics (Heisenberg uncertainty, Schroedinger eq, Particles in box)
2	2018/9/11	Quantum physics (quantum mech. harmonic oscil. , rigid rotor, angular momentum)
	2018/9/13	Quantum physics (spin, Pauli exclusion principle, symmetry of wave function)
3	2018/9/18	Quantum chemistry (atomic electronic structure, hydrogen, multi-electron atoms)
	2018/9/20	Quantum chemistry (periodic table, ionization energy, electron affinity)
4	2018/9/25	holiday
	2018/9/27	Quantum chemistry (electronic structure of molecules, chemical bonds)
5	2018/10/2	Quantum chemistry (electronic spectroscopy)
	2018/10/4	Quantum chemistry (interaction of molecules with light, molecular spectroscopy)
6	2018/10/9	holiday
	2018/10/11	Classification of solids (covalent, molecular, ionic crystals, mixed ionic and covalent)
7	2018/10/16	Crystal binding (van der Waal interaction, cohesive energy, Madelung energy)
	2018/10/18	Crystal structure (crystal lattice, the reciprocal lattice, Brillouin zone)
8	2018/10/23	Phonons and lattice vibrations I (quantization of lattice vibrations, phonons)
	2018/10/25	Phonons and lattice vibrations II (generation of phonons, optical properties)
9	2018/10/30	Thermal properties of solids I (lattice heat capacity, density of modes)
	2018/11/1	Thermal properties of solids II (thermal expansion, thermal conductivity)
10	2018/11/6	Dielectric properties of solids I (polarization, depolarization field)
	2018/11/8	Dielectric properties of solids II (local electric field, Clausius-Mossotti eq.)
11	2018/11/13	Energy bands in solid I (free electron model, number of orbitals in band)
	2018/11/15	Energy bands in solid II (Fermi surfaces, electrons, holes, experimental methods)
12	2018/11/20	Semiconductor crystals I (band gap, intrinsic carrier concentration)
	2018/11/22	Semiconductor crystals II (impurity states, energy bands in Si and Ge, p-n junctions)
13	2018/11/27	Magnetism in solids I (diamagnetism, paramagnetism)
	2018/11/29	Magnetism in solids II (ferromagnetism)
14	2018/12/4	Optical phenomena (color of crystals, luminescence)
	2018/12/6	Point defects (lattice vacancies, color centers)

Midterm exam I: Oct 12 (Fri.)

Midterm exam II: Nov. 9 (Fri.)

Final exam: Follow the University schedule