ESG 281 ENGINEERING INTRODUCTION TO THE SOLID STATE (REQUIRED)

Credit: 3

COURSE CATALOG DESCRIPTION:

This course is concerned with fundamental topics in modern physics, chemistry, and materials science with applications in engineering and technology. Introduces the student to the physics that explain optical, electronic, and mechanical properties of solids and how those properties are related to the nature of the bonds that hold atoms together.

PRE- OR COREQUISITE(S): Calculus, Physics I and II, Chemistry

TEXT(S) OR OTHER REQUIRED MATERIAL: MAIN TEXTBOOK: Text: J.R. Taylor, C.D. Zafiratos, and M.A. Dubson, "Modern Physics for Scientists and Engineers", 2nd edition. Prentice Hall (2004)

Additional Textbooks covering the same of similar materials

. R.A. Serway, C.J. Moses, and C.A. Moyer, "Modern Physics". Saunders College Publishing. (Philadelphia, 1989 or later). Good chapter on lasers

. M.R. Wehr, J.A. Richards, Jr. and T.W. Adair, "Physics of the Atom". Addison-Wesley. (Reading, Mass. 1985 or later). Leading toward chemistry view.

. R.L. Sproull and W.A. Phillips, "Modern Physics: The quantum physics of atoms, solids, and nuclei". Kriegar Publishing (1980). Competent, rigorous, quantitative, still the best.

. Atam P. Arya, "Elementary Modern Physics". Addison-Wesley (Reading, Mass. 1974).

. T.R. Sandin, Essentials of Modern Physics, Addison-Wesley (Reading, Mass. 1989).

COURSE LEARNING OUTCOMES	SOS	ASSESSMENT TOOLS
Fluency in basic concepts of modern and introductory solid-state physics	a, c, e	Test and homework problems
Application of basic concepts of modern and introductory solid-state physics	a, e, g, k	Test and homework problems
Appreciation of the backgrounds and approaches that led to important discoveries	a, e, j	Test and Practice test problems
Understand professional and ethical responsibilities	c	Exam problem
Ability to use calculators and obtain realistic answers with units consistent with contemporary engineering and science	a, b, e, g, k	Exam problems and Homework

COURSE TOPICS:

Week 1. Mass-energy, relativistic momentum and energy
Week 2. Atoms, atomic mass, mole, e/m, oil drop, Rutherford.
Week 3. Black body, photoelectric effect, X-rays, Compton
Week 4. Atomic spectra, Bohr, Moseley, Franck-Hertz
Week 5. De Broglie, Wave function, Sinusoidal waves, Wave packets, Heisenberg, Wave packet velocity
Week 6. Waves, Particle in a box, stationary states, Particles in a rigid box, Free particle, nonrigid box, Harmonic oscillator
Week 7. 3D Schrodinger equation, 2D central force, Angular momentum, energy levels, Electron shells
Week 8. Electron spin, magnetic moment, Zeeman effect, spin magnetic moment, Anomalous Zeeman effect
Week 9. IPA Pauli exclusion principle, Elements, Periodic table, excited states
Week 10. Absorption, stimulated emission, Spontaneous emission, Lasers
Week 11. Molecules, Ionic, Covalent bonds, H_2 molecule, Excited States, Molecular spectra
Week 12. Bonding, Crystals, Energy bands, Semiconductors, Phonons, Superconductivity

CLASS/ LABORATORY SCHEDULE:

ESG Fall	281	Engnrng Intro to Solid State	LEC	1	MF	12:50 PM	2:10 PM
			REC	R01	RECM	11:45AM	12:40 PM
			REC	R02	RECM	10:40AM	11:35AM
			REC	R03	RECM	2:20 PM	3:15 PM
ESG Spring	281	Engnrng Intro to Solid State	LEC	1	TUTH	8:20 AM	9:40 AM
			REC	R01	RECM	11:45AM	12:40 PM
			REC	R02	RECM	12:50 PM	1:45 PM

CURRICULUM

This course contributes 4 credit hours toward meeting the required 32 hours of College-level Mathematics and Basic Science.

STUDENT OUTCOMES (SCALE 1-3):

A	B	C	D	E	F	G	H	I	J	K
3	1	2		3		1			1	2

3 – Strongly supported **2 – Supported** **1- Minimally supported**

LEAD COORDINATOR(S) WHO PREPARED THIS DESCRIPTION AND DATE OF PREPARATION:

Dr. Vladimir Samuilov 09/15/16