1. MME 3309 Electronic Materials Science and Technology

2. 3 Credit Hours, 3 Contact Hours

3. Associate Prof. David A. Roberson

4. Text book *Principles of Electrical Engineering Materials and Devices, S.O. Kasap, Third Edition*

5. Specific course information
   a. Theory of the electrical, semiconductor, magnetic, and optical properties of materials. The application of quantum mechanics to predict nano-structured material behavior. Applications of nano-structured materials in electronic devices.
   b. PHYS 2421 with a grade of "C" or better and junior standing
   c. Required

6. This course covers the relationship between structure of materials and their electronic properties, and the basic concepts of solid state physics and how they apply to electronic materials.
   a. Learning Outcomes
      - Relate crystal structure, atomic bonding type, doping, microstructure, and temperature on electrical resistivity. (Test I)
      - Understand similarities and differences between thermal and electrical conductivity. (Test II)
      - Explain concepts related to quantum physics such as work function, tunneling, photon emission, wave-particle duality. (Test II)
      - Classify band diagrams for metals, polymers, and ceramics. Associate Electron diffraction with energy bands. (Test III)
      - Apply concepts of PN Junctions to modern-day electronic devices such as photovoltaics, flash memory cells and LEDs. (TEST IV)

   b. Student Outcomes

	Outcome	**Level***	**Relevant Activities**
1.	(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics	**L**	Association between material structure and electronic material properties is made.
2.	(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare as well as global, cultural, social environmental, and economic	**L**	Health effects of some materials used in semiconductor processing is covered.

	factors.		
3.	(3) an ability to communicate effectively with a range of audiences	**H**	There are several projects where material is presented in a way that students can learn from one another.
4.	(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	**M**	The understanding of electronic material properties is applied to concepts related to alternative energy sources such as photovoltaics.
5.	(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	**H**	There are group projects within the course.
6.	(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions	**H**	Multitude of hands-on activities to grasp the concepts of electrical conductivity, work function, photoelectric effect, among others.
7.	(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	**L**	Students are exposed to cutting edge electronic materials concepts.

7. Brief list of topics to be covered

- Atomic structure and effect on electrical properties
- Thermal conductivity
- Band Diagrams
- Basic Quantum Physics
- P/N Junctions