

Applied Physics – Electronic Devices and Materials (AP-EDM)

Students who are taking the MS Written Comprehensive Exam with major in Applied Physics - Electronic Devices and Materials should have taken the core sequence of ECE230ABC. One graduate-level exam question on the ECE MS Exam will be based on the material taught in ECE230A/230B.

The required materials for the Written Comprehensive Exam are the class lectures, notes, and assigned books for the courses. The topics can be found from the following textbooks,

- Robert F. Pierret, “*Semiconductor Fundamentals*” (Vol 1), Modular series on solid state devices, Addison-Wesley (1989) and
- Robert F. Pierret, “*Advanced Semiconductor Fundamentals*” (Vol. VI), Modular Series on Solid State Devices, Addison-Wesley (1989)
- Y. Taur and T. H. Ning, “*Fundamentals of Modern VLSI Devices*” Cambridge Univ. Press (1998)

The topics that will be tested may include the physics of solid-state electronic materials and devices. Specific topics will include

- (1) Crystal structure of solids, quantum theory and energy band, Bloch theory, effective mass, Fermi level and band diagram,
- (2) Equilibrium carrier Statistics, carrier generation and recombination, carrier transport, phonons, Poisson’s equation, excess carriers in semiconductors,
- (3) PN Junction
- (4) MOS devices, MOSFETs, CMOS performance factors,
- (5) Bipolar transistors and SiGe bipolar devices.
- (6) Principles of CMOS and bipolar scaling to nanometer dimensions and their high frequency performance in digital and analog circuits.