THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Physical Electronics of Advanced Semiconductor Devices

ECE 7032

Credit Hours:
3.00 - 3.00

Course Levels:
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
MOSCAPs, Gated Diode, CMOS Bulk/SOI Transistors, Photodiodes, Carrier Transport/Storage, Scaling, Mobility, CCDs, CMOS, EEPROMs, SiGe, SiC, ISFETs, BJTs, Noise and Modeling.

Prerequisites and Co-requisites:
Prereq: 5530 (730) or 6531.

Course Goals / Objectives:
- Students learn about quantum effects of device scaling on performance and reliability
- Students learn modeling of MOS transistors, CCDs, EEPROMs and other devices
- Students learn measurement techniques for device characterization

Course Topics:

- Historical overview: MOSCAP, gated diode, high-K dielectrics, amphoteric traps
- Generation-recombination theory, equilibrium, non-equilibrium, steady-state and non-steady-state, conductance, surface recombination boundary conditions
- CCDs, carrier transport and operation, transfer efficiency, charge control model
- CMOS transistors (bulk, SOI, mobility, transconductance, subthreshold operation, SPICE modeling, short-channel and narrow-width effects, surface and buried channel devices, propagation delay, ion-sensitive FETs (ISFETs), hot carrier injection
- Charge pumping, interface and dielectric traps
- Physics of tunneling- floating gate and SONOS EEPROMs
- Theory of drift-field bipolar junction transistors (BJTs)
- SiGe FETs and SiC devices
- Advanced research topics (e.g. mobility, surface roughness, Coulomb scattering, noise)

Designation:

Elective