ELECTRICAL ENGINEERING (ELEC)

ELEC 3330 Optics (3)
Geometrical, physical and quantum optics, with an emphasis on the classical electromagnetic aspects of optics pertaining to scattering, reflection, refraction, dispersion, polarization and interference. Applications to optical instruments, spectroscopy, interferometry, and Fourier optics.

Prerequisite(s): PHYS 1320 and MATH 2210.
A minimum grade of D- is required in PHYS 1320 and MATH 2210.

ELEC 4340 Applied Quantum Systems (3)
This course covers modern topics in quantum technologies, providing an introduction to current and near-term quantum information systems with a focus on applications. This includes various quantum computing architectures, quantum networks and sensing, quantum measurements, quantum cryptography, and quantum imaging. Experiential learning will take place via in-class “laboratories” using various cloud-based quantum systems.

Prerequisite(s): PHYS 2350.
A minimum grade of D- is required in PHYS 2350.

ELEC 6240 Quantum Devices and Electronics (3)
Introduces the physics and engineering of quantum devices, from fundamentals to applications. Topics include quantum states, tunneling, and transport in low-dimensional systems; device architectures such as single-electron transistors, quantum dots, Josephson junctions/SQUIDs, and qubits; and practical methods in nanofabrication, packaging, low-noise measurement, and basic cryogenics. Hybrid labs (facility rotations and benchtop/simulation modules) emphasize design, fabrication/packaging, and transport measurements. For graduate students enrolled in PHYS/ENGP/ELEN 6240, additional advanced homework problems, a research-oriented literature assignment, and a more in-depth final design project are required, with grading standards calibrated to graduate-level expectations.

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ELEC 6420 Probabilistic Systems and Signal Processing (3)
Many real-world phenomena and systems are probabilistic in nature, where the outcome of an experiment has uncertainty. Examples can be found everywhere including medical diagnosis and spread of disease, electronic devices, communication and information systems, internet traffic and social networks, gambling, financial markets, polling and elections, renewable energy, sports, etc. The modeling and analysis of probabilistic systems involve the fields of probability theory, statistics, machine learning, and statistical signal processing. This course covers the basic concepts and techniques of probability theory with application to statistics, machine learning, and statistical signal processing. Topics include probability and counting, conditional probability, Bayes rule, independence, random variables and processes, expectation and correlation, variance and covariance, conditional expectation, signal estimation, limit theorems, minimum mean square error estimation, linear estimation, and confidence intervals. Coursework includes computational problems in MATLAB with automatically generated and real data.