SPRING 2024
NEW AND ENHANCED COURSES

FIU | Electrical & Computer Engineering

Contents

ECE New Courses

The ECE department at FIU is adding new undergraduate and graduate courses in the following areas:

(i) Clean Energy,
(ii) Electric Vehicle Engineering,

(iii) Robotics,
(iv) Microelectronics and Semiconductors for the CHIPS Act,
(v) Quantum Engineering.

New courses were added in spring 2024, covering topics in Applied Photovoltaics, Signal Processing, Quantum Computers, Foundation of Electrical Vehicle Engineering, Artificial Intelligence, Big Data, Applied Nuclear Engineering, Radar Systems, among others. Some of these courses will be available starting Spring 2024, with new additions continuing in fall 2024.

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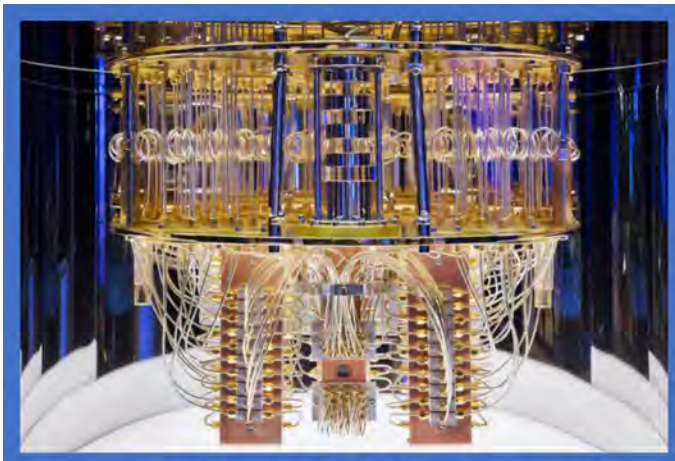


SPRING 2024

Jan 08, 2024—Apr 20, 2024

Mode: Fully Online

Course Prerequisites:
- EEL 3120 Linear Systems
- EEL 3135 Signals & Systems

or
- Permission of Instructor

EEE 4423 RVC - Introduction to Quantum Computers

Course Summary

The course Introduction to Quantum Computers offers a comprehensive exploration of the fundamental principles and applications of quantum computing. Covering topics such as quantum theory, hardware architectures, quantum gates, and practical implementations, students will gain a solid understanding of this revolutionary field. Through a combination of theoretical concepts and real-world examples, participants will develop the necessary knowledge and skills to navigate the exciting world of quantum computers and their potential impact on various industries.

Topics Covered

- Quantum Theory
- Quantum Gates
- Quantum Algorithms
- Quantum Entanglement
- Quantum Circuits
- Quantum Error Correction
- Quantum Hardware
- Quantum Cryptography
- Quantum Simulators
- Quantum Applications

Course Benefit

- Comprehensive understanding of quantum computing principles and applications.
- Practical knowledge of quantum computing's real-world applications.
- Industry-relevant insights into state-of-the-art hardware and emerging technologies.
- **Opportunity for top students to secure internships in industry or academia, enhancing their practical experience and professional network.**

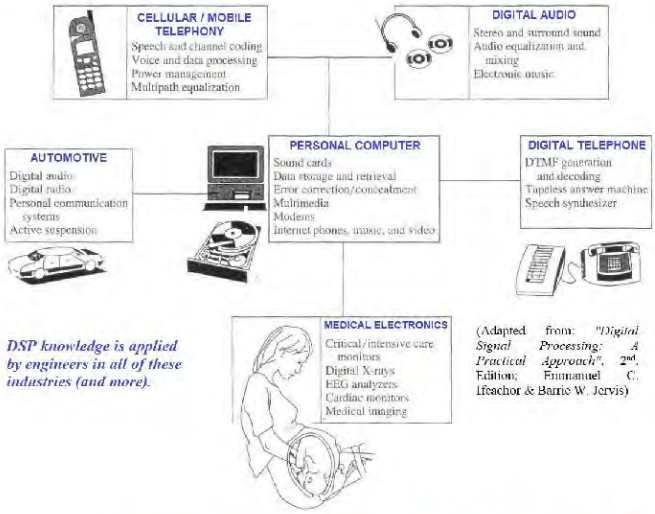
For more information, contact
Prof. Alex Krasnok
akrasnok@fiu.edu

EEE4510: Introduction to Digital Signal Processing (DSP)

Spring 2024 – Tuesdays & Thursdays 2 pm – 3 :15 pm @ EC--1109

Instructor: Dr. A. Barreto , barretoa@fiu.edu *Prereq.*: EEL 3135 or instructor permission

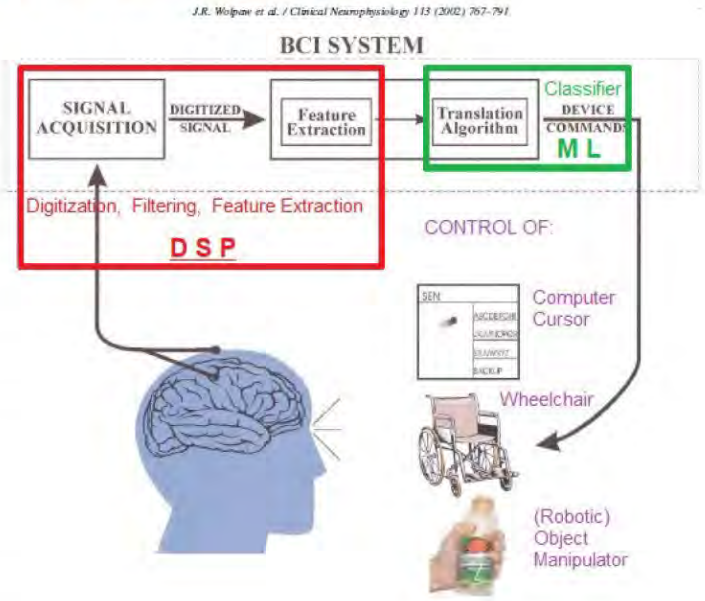
OVERVIEW: Analysis of discrete time signals and the systems developed for processing them, *which have application in a vast variety of systems we use in contemporary life and in engineering practice.*



YOU WILL LEARN:
How to correctly CONVERT analog signals to digital signals, to be processed by a computer (μP, DSP chip)
How to ANALYZE the frequency contents of a digital signal (DFT, Periodogram, Spectrogram)
The theoretical basis for the ANALYSIS of discrete time systems
The use of the Z-Transform for their analysis
How to find and plot their Frequency Response
How to IMPLEMENT typical DISCRETE TIME PROCESSING SYS.
An introduction to the DESIGN of Digital Filters (Low pass, High pass, etc.)
How to Design and Implement Digital Filters in Matlab®
* You will learn these both "theoretically" AND IN Matlab®

You have to "DSP it" before you can "ML it"

We all continue to be amazed by the goals that Deep Learning, and MACHINE LEARNING (ML) in general, are reaching. *However, since many signals occur originally as analog signals, it is necessary to apply some DIGITAL SIGNAL PROCESSING (DSP) to them, even before they can be used in an ML system*. The figure to the right shows an example. A Brain-Computer Interface (BCI) system pursues the control of devices (e.g., wheelchair) from Electroencephalogram (EEG) signals, but the EEG signals must first be correctly digitized and digitally pre-processed (e.g., filtered) and then FEATURES must be extracted from them by DSP processes, before the features can be taken in by an ML system.



FIU Engineering & Computing
FLORIDA INTERNATIONAL UNIVERSITY

CONTROL TECHNIQUES

KB

EEL 4930/5935:
FOUNDATIONS OF ELECTRIC VEHICLE ENGINEERING

SPRING 2024

Interested in a career in electric vehicle engineering? Register for **EEL 4930/5935**: Foundations of Electric Vehicle Engineering. Through lectures and hands-on class experiments, students will learn about vehicle dynamics, motor design and control, power converters, controller area network (CAN) protocol, battery technology, and more. *For this course, FIU has partnered with Control Techniques and KB Electronics (Nidec Companies).*

Pre-requisites:
Required: Physics 1 & 2 (PHY2048 and PHY2049 or equivalent)
Recommended: Circuit Analysis (EEL3110C or equivalent)

Spring 2024
Mondays & Wednesdays 6:25PM to 7:45PM
Engineering Center, Room EC1115

FOR MORE INFORMATION:
Amaury P. Betancourt, PhD, PE
abetanco@fiu.edu

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

Applied Nuclear Engineering

Spring 2024

EEL 4930 U08 Sp Top Elec Eng
EEL 5935 U08 Adv Spec Topics

Class Date: January 08--April 20
Time: Tuesday & Thursday
11:00 am--12:15 pm
Room: EC 2420

Course Overview

Radiation is the central aspect which makes nuclear science and engineering (NSE) its own discipline, and sets the foundation for almost all of modern physics.

We will begin by retracing the steps of famous radiation experiments and hypotheses. Next we will set the stage and context for our study of radiation, by showing details of the systems and reactors which use radiation. The rest of the course will be dedicated to describing the origins, interactions, uses, detection, and biological/chemical effects of ionizing radiation.

Course Topics

- Nuclear Mass and Stability, Nuclear Reaction and Notation, Introduction to Cross Section
- Q-Equation Continued and Examples
- Radioactive Decay Continued
- Nuclear Reactor Construction and Operation
- Ion-Nuclear Interactions
- How Nuclear Energy Works
- Simplifying Neutron Transport to Neutron Diffusion
- Transients, Feedback, and Time-Dependent Neutronics
- Nuclear Materials-Radiation Damage and Effects in Matter
- Radiation Dose, Dosimetry, and Background Radiation
- Radiation Hormesis

Course Objectives

- Dive deep into the origins, interactions, and effects of ionizing radiation.
- Learn the practicalities of nuclear reactor construction and operation
- With a focus on radiation dose, dosimetry, and background radiation, students will be well-equipped to understand the implications and relevance of radiation in everyday life.
- From understanding how nuclear energy works to the intricate details of ion-nuclear interactions, students will receive a holistic education, covering both theoretical concepts and practical applications.

Speakers will be invited from Idaho National Laboratory (INL)

For more information, contact Prof. Deidra R. Hodges, ***dhodges@fiu.edu***

Applied Photovoltaics

Course Overview:

This course presents the fundamental principles of the solar energy conversion process and the most common cell technologies are discussed. It will also cover a range of fundamental problems and the relationship between the physics, material science, and technology aspects of solar cell development.

Spring 2024

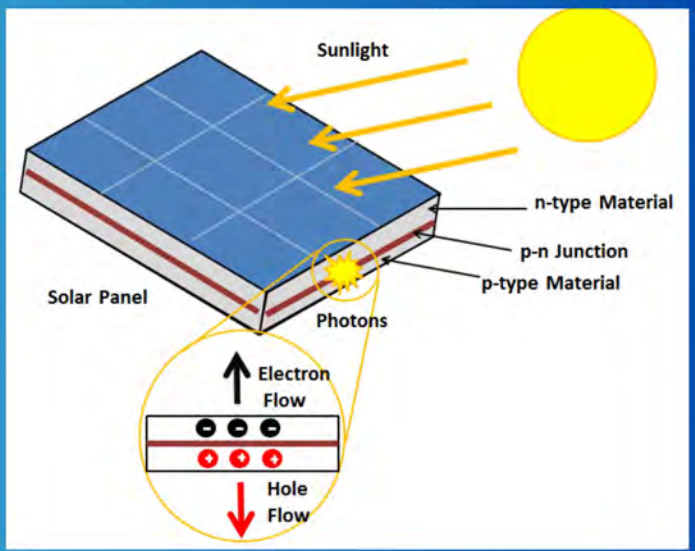
EEL 4930 U09 Sp Top Elec Eng

EEL 5935 U09 Adv Spec Topics

January 08--April 20
Tuesday & Thursday
12:30 pm--1:45 pm

Room: EC 1113

Prerequisites: EEL 3110C



Course Topics

- PV Introduction and Background
- Semiconductors and p-n junctions
- The Behavior of Solar Cells
- Cell Properties and Design
- Thin-Film Compound Semiconductors
- PV Cell Interconnection and Module Fabrication
- PV System Components(Balance of System)
- Design of Grid-Connected PV Systems
- Specific Purpose PV Applications

Speakers will be invited from Florida Power Light (FPL)

Course Objectives

- List and describe the balance of system components of a solar energy photovoltaic system
- Discuss remedies/potential solutions to the supply and environmental issues associated with photovoltaics, compared to other energy sources
- Simulate, describe, and illustrate basic electrical concepts and system components of a photovoltaics system
- Design, build, and demonstrate a photovoltaic power generation system that delivers power to and drives a load

For more information, contact Prof. Deidra R. Hodges, ***dhodges@fiu.edu***

Course Title: ***Smart Mobility with Electric Vehicles (EV), Charging Systems, and Reliability Assessment***

Course Overview*: This course aims to provide students with a deep understanding of electric vehicles (EVs), their charging infrastructure (including wireless charging), and methods for assessing the reliability of EV components. Through a combination of theoretical knowledge and hands-on experience, students will gain expertise in the rapidly evolving field of electric mobility.*

This 15-week course covers most of the aspects of EV and mobility infrastructure. Provides hands on experience in different laboratories as well on 02 EVs on campus. Industry experienced professors along with EV researchers would be providing lectures and end-end experience for potential students.

Course Duration: *15 weeks (one semester)*

Course Instructors: *Arif Sarwat, Eminent Scholar Chaired Professor and Dr. Mohd Tariq (Visiting Scholar and Assistant Professor, India)*

Contact: *asarwat@fiu.edu and/or tmohd@fiu.edu*

Course Objectives: *By the end of the course, students should be able to:*

i. *Understand the fundamentals of electric vehicle technology.*
ii. *Describe various EV charging technologies, including wireless charging.*
iii. *Assess the reliability of EV components using appropriate methods and tools.*
iv. *Apply theoretical knowledge through practical experiments and projects.*
v. *Analyze the environmental and economic impacts of EV adoption.*

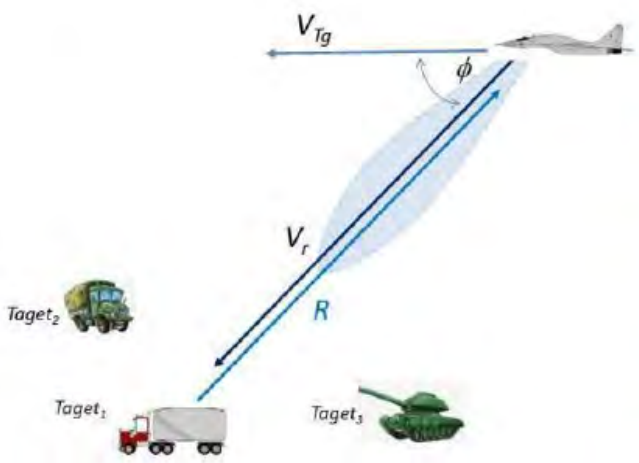
FIU's EV Mobility and Infrastructure Team Since 2012. EPSi: Energy Power & Sustainability Group

EEE 5557 Principles of Modern Radar

Monday/Wednesday 3:30 PM—4:45 PM (08 Jan — 20 Apr 2024)

Course Summary – Introduce recent radar technologies, concepts, challenges, and applications that address the increasingly complex and evolving threat landscape. Topics include state of the art technologies, recent research activities, technical presentations, and journal publications to gain an understanding of radar systems, electromagnetic spectrum, and its importance to national security.

Lectures include an overview of History of Radar, Radar Range Equation, Radio Frequency Loss Budget Formulation, Radar Cross Section, Antenna Technologies, Transmitter/Receiver Devices, Frequency-Modulated Continuous Wave radar, Synthetic Aperture Radar, and Inverse Synthetic Aperture Radar will be discussed. Students will gain an understanding of recent radar capabilities and continual improvements to the technology, including the modern threat systems.



The primary goal is to advance Radar systems development in support of future workforce to the growing requirements to gather, analyze, and process information rapidly which require electromagnetic spectrum access.

EEE 6395 Applied Superconductivity

Join Dr. Larkins as he uses over 40 years of real word and research experience to guide you through the exploration of the mysterious realm of superconductivity. Starting with the lowly hydrogen atom and its noble cousin, helium, we will examine the causes of superconductivity, models for superconductors and how to use this novel and wonderful material in engineering applications of the 21st Century and beyond.

This course will cover:

1. *The fundamentals of superconductivity, why it exists, and the basic properties of superconductivity in bulk materials.*
2. *The macroscopic applications of bulk superconductors (power transmission, magnetic levitation etc.) and the limitations involved.*
3. *The applications and limitations of of thin superconducting films in rf and microelectronics.*
4. *Monolayer superconductors and 2-dimensional superconducting materials, their advantages and disadvantages.*
5. *Aspects of Quantum superconductive devices, how they work and what their fundamental limitations are.*
6. *Elementary RSFQ Logic Gates.*
7. *Quantum computing elements using superconducting Qubits.*

Your coursework will include guided problems on the fundamentals of superconductivity and the writing of several term papers on aspects of superconductivity that the student and Dr. Larkins mutually agree upon.

Come and Explore the Future!

Title: EEE 6399C - Electronic Properties of Materials

Announcing: Electronic Properties of Materials

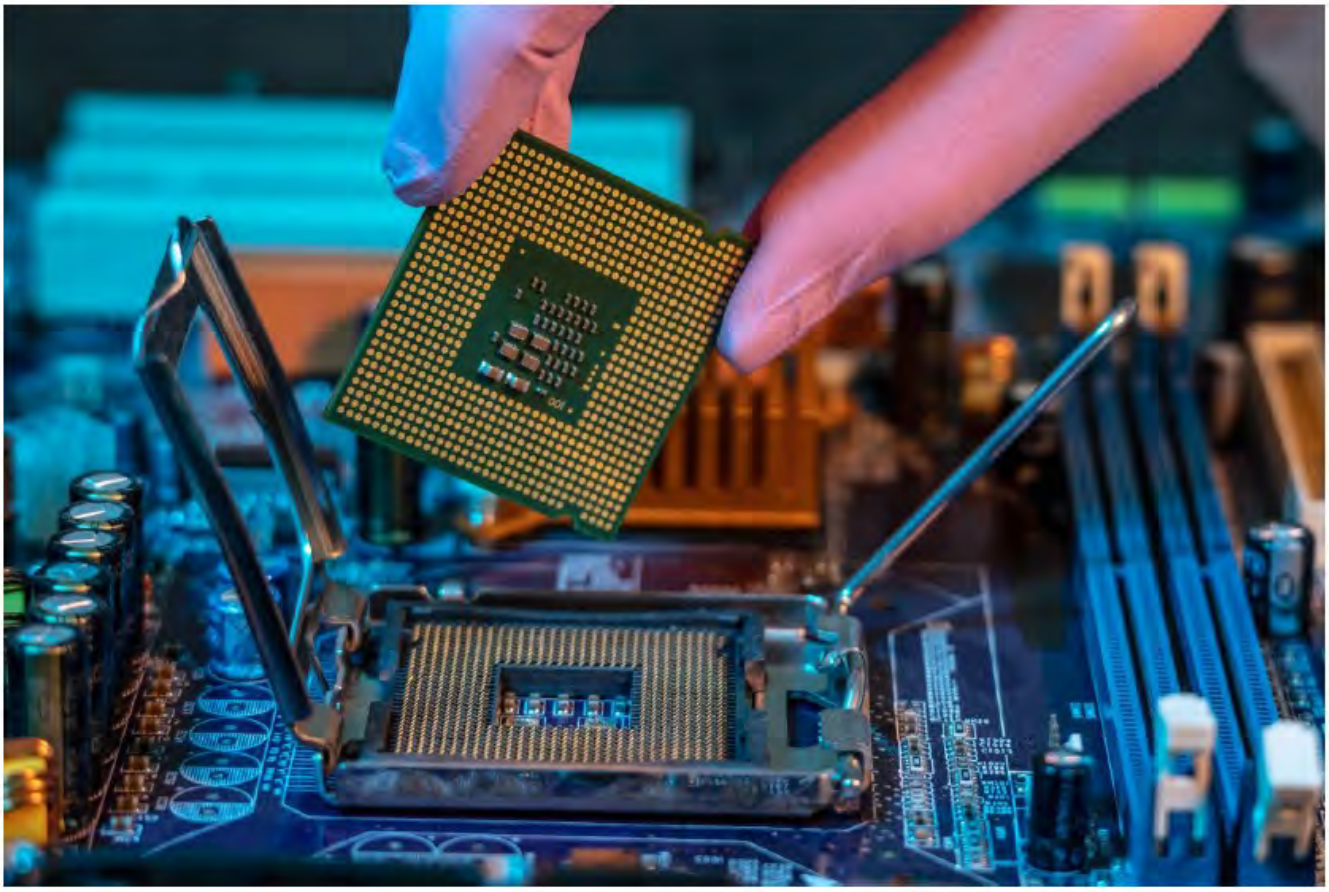
EEE 6399C Spring 2024

What are electronic materials?

Every computer, smart phone, smart watch, and a thousand other products are made using chips. And the chips are made up of materials chosen because of their electronic properties.

What are electronic materials used for?

1. Computer chips: CPU, GPU, memory
2. Embedded systems
3. Photovoltaic devices:
4. Sensors
5. and more and more



Florida International University
Department of Electrical and Computer Engineering
Artificial Intelligence & Big-Data
Himanshu Upadhyay (upadhyay@fiu.edu)
Alexander Perez-Pons (aperezpo@fiu.edu)

Artificial Intelligence & Big Data has new courses in Electrical & Computer Engineering (ECE). Curriculum includes basic and advanced concepts in machine learning, deep learning, big data and cloud technologies. It will help students to identify and solve complex problems from various domains like IoT, Sensors, Energy, Environment, Robotics etc. As part of these courses, student will learn full data science life cycle and its application to various domains. Machine learning course is focused on the implementation of regression, classification and clustering algorithms. Deep learning course is focused on application of image processing and sequencing /time series data using Convolution Neural Network and Recurrent Neural Network algorithms. Student will also learn fundamentals of big data technologies and its applications to large scale data sets. Student will learn data storage using Hadoop Distributed File System (HDFS), apply batch processing and perform in-memory analytics using Spark. They will also learn about Kafka message broker to import data and No-SQL database like Cassandra or Mongo DB. Program also offers Free Microsoft fundamentals training & certifications.

Undergraduate Courses (Spring 2024)

CNT 4153: Machine Learning in ECE + AI 900 AI Fundamentals
CNT 4147: Big Data Analytics in ECE + DP 900 Data Fundamentals
CNT 4155: Python Programming in ECE

Graduate Courses (Spring 2024)

CNT 6150: Advanced Deep learning in ECE + AI 900 AI Fundamentals
CNT 6144: Advanced Analytics with Cloud Services + AZ 900 Azure Fundamentals

FIU Engineering & Computing
Electrical and Computer Engineering

Florida International University
College of Engineering & Computing
Department of Electrical and Computer Engineering
10555 West Flagler Street, EC 3900

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