

# Course Description

## **20701 Seminar & Research Methodology**

**Prerequisite: None**

**Credit Hours: 1**

This course aims at exposing students to the most current developments and trends in the field of electrical engineering. It also aims to improve students' presentation, communication, and writing skills. In addition, the seminar covers basic research methodologies to prepare students for their master's thesis, and provides them with a forum to represent their research work and offer critiques of others' work.

## **20719 Special Topics in Electrical Engineering (1)**

**Prerequisite: To be set by Dept.**

**Credit Hours: 3**

The objective of this course is to introduce advanced and new topics in Electrical Engineering. The topics may change from one semester to another according to latest technological advances and available faculty specializations.

## **20720 Special Topics in Electrical Engineering (2)**

**Prerequisite: To be set by Dept.**

**Credit Hours: 3**

The objective of this course is to introduce advanced and new topics in Electrical Engineering. The topics may change from one semester to another according to latest technological advances and available faculty specializations.

## **20799 Thesis**

**Prerequisite: Finish 15 Credit Hours**

**Co-requisite: 20701**

**Credit Hours: 9**

After reviewing literature, the student defines a research problem under the supervision of a faculty member. Then he/she develops a suitable solution and writes the thesis, describing the targeted problem, his/her suggested solution and obtained results. Afterwards, the student defends his thesis against an appointed examining committee.

## **21701 Advanced Electronics**

**Prerequisite: None**

**Credit Hours: 3**

Linear and non-linear operational amplifier circuits. Frequency response and compensation. A/D converters. CMOS logic design. Introduction to radio frequency logic circuits.

**21702 VLSI Design**  
**Prerequisite: None**  
**Credit Hours: 3**

This course covers all the major steps of the design process which includes: logic, circuit and layout design; a variety of computer aided tools are discussed and used in class; the main objective of this course is to provide VLSI design experience that includes the design of basic VLSI CMOS functional blocks, verification of the design, testing and debugging.

**21703 Communication Circuits and Systems**  
**Prerequisite: None**  
**Credit Hours: 3**

This course covers circuit- and system-level design issues of high speed communication systems with primary focus on wireless and broadband data link applications. Specific circuit topics include: transmission lines, high speed and low noise amplifiers, VCO's and high speed digital circuits. Specific system topics include: frequency synthesizers, clock and data recovery circuit and transceivers.

**21704 Optoelectronics**  
**Prerequisite: None**  
**Credit Hours: 3**

Technology of ultrafast diode LASERs, from the basic physical principles to applications in communications. Ultrafast optoelectronics and applications of semiconductor diode LASER arrays. Coherent and incoherent LASERs. Edge- and surface-emission. Horizontal- and vertical-cavity. Individually addressed, lattice- and strained-layer systems.

**21790 Master Project**  
**Prerequisite: 20701**  
**Credit Hours: 3**

An individual study, under supervision of a faculty member, to demonstrate the student's capability to carry out a given assignment in the field of Electronics Engineering. The student is required to perform several tasks like literature survey, analysis, design and/or prototyping a product. A final report describing the assigned problem, analysis approach and results is required.

**22701 Embedded Systems Design**  
**Prerequisite: None**  
**Credit Hours: 3**

Model-based approach to system level design. Computation and communication modeling techniques. Specifications and transactional levels modeling. System level architecture synthesis. Embedded hardware and software components. Simulation and verification methods.

**22702 Real-Time Computing**

**Prerequisite: None**

**Credit Hours: 3**

Principles of real-time computing. Hard and soft real-time systems. Multitasking. Scheduling policy. Periodic and aperiodic task scheduling. Priority driven schedulers. Earliest deadline first algorithm. Adaptive partition scheduler. High performance systems. Reliability applications.

**22703 Advanced Computer Architecture**

**Prerequisite: None**

**Credit Hours: 3**

Review of computer design principles. Software and hardware to exploit instruction level parallelism (ILP). Limits on ILP-level parallelism, multiprocessors, multi-core processors and multi-threading. Cache coherence and memory consistency. Advanced memory hierarchy design. Advanced topics in storage systems. Designing and evaluating I/O systems.

**22704 Advanced Computer Networks**

**Prerequisite: None**

**Credit Hours: 3**

Overview of computer networks. Wireless and mobile networks. Multimedia networking. Security in computer networks. Network management. Network modeling and simulation.

**22705 Algorithms and Architectures**

**Prerequisite: None**

**Credit Hours: 3**

Design methodology including: algorithm representation pipeline and retiming, unfolding and folding. Systolic array. Bit-level and redundant arithmetic. Sub expression sharing. Synchronous and asynchronous waves. Synthesis and CAD.

**22790 Master Project**

**Prerequisite: 20701**

**Credit Hours: 3**

An individual study, under supervision of a faculty member, to demonstrate the student's capability to carry out a given assignment in the field of Computer Engineering. The student is required to perform several tasks like literature survey, analysis, design and/or prototyping a product. A final report describing the assigned problem, analysis approach and results is required.

**23701 Stochastic Processes**

**Prerequisite: None**

**Credit Hours: 3**

Review of probability theory and random variables. Mathematical description of random signals. Linear system response. Wiener, Kalman and other filters. Time averages and ergodicity. Systems response to random signals. Markov chains.

**23702 Digital Communication**

**Prerequisite: 23701**

**Credit Hours: 3**

Base band pulse transmission. Base band systems optimization. Linear and nonlinear digital modulation techniques. Source coding. Performance in additive Gaussian noise channel. Matched filtering. Continuous phase modulation. Carrier acquisition and recovery. Channel coding principles. OFDM communications systems.

**23703 Wireless Communications**

**Prerequisite: 23702**

**Credit Hours: 3**

Digital signaling over fading multipath channels. Spread spectrum signals for digital communications. Multiple access systems. Time-division multiple access. Code-division multiple access. Frequency-division multiple access. Diversity and MIMO systems.

**23704 Advanced DSP**

**Prerequisite: None**

**Credit Hours: 3**

Wiener filters. Linear prediction. Least Mean Square (LMS) adaptive filters. Normalized NLS adaptive filters. Recursive Least Square algorithms. Kalman filters. Implementing adaptive filters using MatLab.

**23705 Coding Theory**

**Prerequisite: 23702**

**Credit Hours: 3**

Coding techniques: Reed Salmon, Hamming, and convolution. Concatenated serial and parallel, hard and soft decision decoding methods. Turbo codes decoding. The maximum a posteriori algorithm (MAP). The soft output algorithms. Bit Error Rate evaluation (BER).

**23706 Optical Communications**

**Prerequisite: None**

**Credit Hours: 3**

Introduction to optical communications. Propagation of light in an optical fiber. Semiconductor losses for optical communications. Optical components: passive, WDM, optical filters, optical modulators and optical amplifiers. Analogue and digital coding. Signal to noise considerations. Optical systems and networks. System design.

**23790 Master Project**

**Prerequisite: 20701**

**Credit Hours: 3**

An individual study, under supervision of a faculty member, to demonstrate the student's capability to carry out a given assignment in the field of Communications Engineering. The student is required to perform several tasks like literature survey, analysis, design and/or prototyping a product. A final report describing the assigned problem, analysis approach and results is required.

**24701 Advanced Power Electronics**

**Prerequisite: None**

**Credit Hours: 3**

Electronic conversion and control of electrical power: semiconductor switching devices, power converter circuits and control of power converters. AC/AC, AC/DC, DC/DC and DC/AC power converters. Circuit simulation. Advances in batteries.

**24702 Distributed Generation**

**Prerequisite: None**

**Credit Hours: 3**

Steady state operation of Distributed Generation (DG): voltage rise, losses and reactive power control. Fixed and variable speed induction generators. Fault currents from DG. Fault current limiters and protection. Active distribution networks. Contribution of DG to system security.

**24703 Protection of Power Systems**

**Prerequisite: None**

**Credit Hours: 3**

Protection system components. Types of relays and circuit breakers. Protection of generation, bus bars, transformers and lines.

**24704 Digital Control**

**Prerequisite: None**

**Credit Hours: 3**

Discrete-time systems. Difference equations. Z-transform. Inverse Z-transform. Flow graphs. State variables. Transfer functions. Sampling and reconstruction of control systems. Zero-order and first-order hold. System time response characteristics. Stability analysis. Bi-linear transform. Jury's stability test. Pole assignment and state estimation. Controllability and observability. Ackerman's formula. Linear quadratic optimal control.

**23790 Master Project**

**Prerequisite: 20701**

**Credit Hours: 3**

An individual study, under supervision of a faculty member, to demonstrate the student's capability to carry out a given assignment in the field of Power Engineering. The student is required to perform several tasks like literature survey, analysis, design and/or prototyping a product. A final report describing the assigned problem, analysis approach and results is required.

**31731 Engineering Analysis**

**Prerequisite: None**

**Credit Hours: 3**

Power series solution of differential equations and special functions (Bessel's functions and the Fourier-Bessel Series). Solutions of partial differential equations, heat and wave equations and Laplace equation. Sturm-Liouville problems and orthogonal functions in orthogonal coordinate systems. Separation of variables. Fourier series and Fourier integral. Complex Integration.