



University of Nicosia, Cyprus

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| Course Code ECE-310 | Course Title Digital Integrated Circuits | ECTS Credits 6 |
| Department Engineering | Semester Fall | Prerequisites ECE-110, ECE-212 |
| Type of Course Required/Elective | Field Engineering | Language of Instruction English |
| Level of Course 1 st Cycle | Year of Study 3 rd | Lecturer(s) Dr Stelios Neophytou |
| Mode of Delivery Face-to-face | Work Placement N/A | Co-requisites None |

Objectives of the Course:

The main objectives of the course are to:

- Offer extensive knowledge and a broad foundation on the operation and design of digital integrated circuits
- Explain the DC and transient behavior of a broad family of digital integrated circuits
- Provide the knowledge and tools needed for the analysis and design of digital integrated circuits
- Provide understanding of the major differences among the various families and designs of digital integrated circuits
- Introduce students to proper software used for modeling and analysis of digital integrated circuits
- Demonstrate the operation and design of basic digital blocks

Learning Outcomes:

After completion of the course students are expected to be able to:

- Explain the fabrication process and details of the internal operation of the various known families in digital integrated circuits
- Analyze a digital integrated circuit in terms of its Voltage Transfer Characteristic (VTC), Power Dissipation, maximum Fan-out, noise margins, transient characteristics, and power delay product
- Use commercial software for the analysis and design of digital integrated circuits
- Discuss the pros and the cons of the various families of digital integrated circuits including RTL, DTL, TTL, STTL, ECL, MOS, NMOS, CMOS
- Design basic logic gates using different types of technologies such as those based on BJT, Schottky-clamped BJT, MOS, NMOS, and CMOS transistors
- Evaluate the performance of digital integrated circuits and classify them according to their performance characteristics

Course Contents:

- Properties, definitions and performance characteristics of digital integrated circuits
- Introduction to diodes and bipolar junction transistors
- Bipolar digital integrated circuits, Resistor-Transistor Logic (RTL), other logic gates, RTL fan-out, power dissipations, fan-out, etc
- Basic Diode-Transistor Logic (DTL) inverter, modified DTL, DTL NAND, fan-out, power dissipation, etc
- Basic Transistor-Transistor Logic (TTL) inverter, TTL NAND, multiple emitter BJT, standard TTL NAND gate, voltage transfer characteristic (VTC), power dissipation, fan-out, other TTL gates, transient analysis
- Schottky-clamped TTL (STTL), Low-Power STTL (LSTTL), Advance STTL (ASTTL), VTC, fan-out, power dissipation, transient analysis
- Emitter-Coupled Logic (ECL), NOR/OR gate using ECL technology, MECL NOR/OR gate, VTC, power dissipation, fan-out, transient analysis
- Metal Oxide Semiconductor Field Effect Transistor (MOSFET), N-Channel MOS (NMOS), PMOS, modes of operation, threshold voltage, capacitances
- MOS digital circuits, NMOS inverter, resistor-loaded NMOS invertir, saturated enhancement-only loaded NMOS inverter, fan-out, power dissipation, etc
- CMOS technology, operation of CMOS inverter, fan-out, power dissipation, VTC, capacitances

Learning Activities and Teaching Methods:

Lectures, in-class assignments

Assessment Methods:

Homework, computer assignments, projects, exams, final exam.

Required Textbooks/Reading:

| Authors | Title | Publisher | Year | ISBN |
|------------------------------------|-----------------------------|---------------------|------|------------|
| Thomas A. DeMassa and Zack Ciccone | Digital Integrated Circuits | John Wiley and Sons | 2008 | 0471108057 |

Recommended Textbooks/Reading:

| Authors | Title | Publisher | Year | ISBN |
|---------------|--|-----------|------|------------|
| John E. Ayers | Digital Integrated Circuits: Analysis and Design | CRC | 2003 | 084931951X |