# NATIONAL UNIVERSITY OF ENGINEERING
## COLLEGE OF ELECTRICAL AND ELECTRONICS ENGINEERING
## ELECTRONICS ENGINEERING PROGRAM

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# SYLLABUS - EE636 DIGITAL SYSTEMS II

## I. GENERAL INFORMATION

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| **CODE** | **:** | EE636 |
| **SEMESTER** | **:** | |
| **CREDITS** | **:** | 4 |
| **HOURS PER WEEK** | **:** | **5** (Theory – Practice – Lab) |
| **PREREQUISITES** | **:** | EE635 Digital Systems I |
| **CONDITION** | **:** | Elective |
| **INSTRUCTOR** | **:** | Cesar Briceno, Aurelio Morales, |

## II. COURSE DESCRIPTION

At the end of the course the student will be able to carry out the analysis and design sequential circuits, using mathematical tools such as Boolean algebra.
It encompasses: Sequential circuits analysis, timing diagram, state diagrams and tables. Design of sequential circuits. Application of design method for sequence detectors, counters and registers. Data storage circuits: memories.

## III. COURSE OUTCOMES

1. Identify characteristics of sequential circuits to make applications of several circuits in problem solving.
2. Analyze various types of sequential circuits using the provided analysis tools: state diagrams and tables.
3. Design sequential circuits using design and state reduction methods.
4. Apply definitions of sequence detector in the circuit's implementation.
5. Design various types of register and apply the best in the problem solving.

## IV. LEARNING UNITS

### 1. ANALYSIS AND DESIGN OF SYNCHRONOUS SEQUENTIAL CIRCUITS / 28 HOURS

Flip-flop basic concepts / Characteristic tables / State diagrams and tables / Sequential circuits design/ State machines/ Counters: definition / Types of counters / Registers/ Register implementation with ICs.

### 2. ASYNCHRONOUS SEQUENTIAL CIRCUITS / 4 HOURS

Asynchronous sequential circuits design/ Flowchart/ Transitions table/ Hazard detection and elimination.

### 3. PROGRAMMABLE LOGIC DEVICES / 16 HOURS

Semiconductor memories: Classification/ RAM/ ROM/ Memory implementation of combinational circuits/ Memory implementation of sequential circuits.

### 4. STRUCTURED LOGIC / 4 HOURS

Introduction to State machines/ Flip-flop's state method/ Multiplexer method/ Counter method/ Memory method.

## V. LABORATORY EXPERIENCES

**Lab 1**: Introduction to simulation package.
**Lab 2**: LSI and MSI logic circuits review.
**Lab 3**: Design and Implementation of synchronous sequential circuits (part 1)
**Lab 4**: Design and Implementation of synchronous sequential circuits (part 2)
**Lab 5**: Flip-flop counters implementation.
**Lab 6**: Implementation of counters with ICs.
**Lab 7**: Flip-flop registers implementation.
**Lab 8**: Applications in VHDL language.

## VI. METHODOLOGY

The course is carried out in computing lab, theory and practice sessions. In theory sessions, the instructor introduces concepts, theorems and applications. In practice sessions, several problems are solved, and their solutions are analyzed. In lab sessions, simulation software is used to solve problems and analyze their solutions. This analysis is the complement for the implementation of integrated circuits that students must hand in every lab session. In all sessions student's active participation is encouraged.

## VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

**PF=(EP+EF+((P1+P2+P3+P4)/4+(L1+L2+L3+L4+L5+L6+L7+L8)/8)/2)/3**

EP: Mid-Term Exam EF: Final Exam P#: Quizzes L#: Labs

## VIII. BIBLIOGRAPHY


1. **MORRIS – MANO**
   Digital Logic and Computer-aided Design (Spanish)
   Prentice Hall Editorial, 2003

2. **TOCCI, RONALD**
   Digital Systems (Spanish)
   Prentice Hall Editorial, 2003

3. **DE MICHELIS, GIOVANNI**
   Synthesis and Optimization of Digital Circuits