NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ELECTRICAL AND ELECTRONICS ENGINEERING

TELECOMMUNICATIONS ENGINEERING PROGRAM

IT114 – DIGITAL ELECTRONIC CIRCUITS

I. GENERAL INFORMATION

CODE	**:**	IT114 – Digital Electronic Circuits
SEMESTER	**:**	7
CREDITS	**:**	04
HOURS PER WEEK	**:**	05 (Theory – Practice)
PREREQUISITES	**:**	EE421 – Electronic Circuits I
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

The course provides the student with the knowledge and use of digital electronic circuits in design applications for the telecommunications engineering profession.

III. COURSE OUTCOMES

At the end of the course the student will:

- Recognize the importance of digital electronic circuits in telecommunications.
- Know how to use digital electronic circuits for processing analog or digital signals.
- Use computer simulation programs to solve analog/digital problems.

IV. LEARNING UNITS

1. INTRODUCTION

Most used logical families. Case ECL, TTL, ICL, MOS, CMOS, BICMOS, drivers and interfaces between logical families, noise levels and reliability in the different logical families.

2. BASIC DIGITAL ELECTRONIC ELEMENTS

The basic inverter TTL, CMOS, BICMOS. Latches and Flip-Flops, and their implementation. Devices commanded by clock level and clock edges.

3. REPRESENTATION OF DIGITAL NUMBERS

Representation of signed and unsigned numbers, representation of fixed point and floating-point numbers, convergent rounding. Digital arithmetic algorithms (addition, subtraction, multiplication, division) using digital representation formats. (parallel and serial arithmetic).

4. **MEMORIES AND DIGITAL STORAGE DEVICES**
   Structure of digital storage devices, manufacturing technology, access methods, read / write storage devices. Examples: SRAM, E2PROM (reconfigurable ROMs), FLASH PROM, dynamic RAMs (burst RAM, EDO), advantages and disadvantages with respect to the SRAM.

5. **ANALOG / DIGITAL CONVERSION**
   Analog/digital conversion algorithms, advantages, disadvantages, estimation of quantization errors, expansion and compression algorithms (μ-Law, A-Law), fast converters.

6. **HARDWARE DESCRIPTION LANGUAGE (HDL)**
   Hardware description languages, VHDL digital description languages and AHDL analogue, Analog digital simulation. Simulation of analog / digital circuits, method of currents, voltages, combined methods. Examples: SPICE, HSPICE.

7. **FILTERS WITH SWITCHED CAPACITORS**
   Theory of operation, analysis, design, and applications of switched capacitors.

8. **INTRODUCTION TO DIGITAL FILTERS**
   Architecture of a digital filter, operation, and applications.

V. METHODOLOGY

The course is developed in theory and practice sessions, in the theory sessions the professor introduces several digital electronics circuits used for processing analog or digital signals, and in the practical sessions various problems are solved by analyzing the solutions and indicating the real application of digital electronic circuits. In all the sessions the active participation of the student is promoted.

VI. EVALUATION FORMULA

The learning will be evaluated through the "F" system:

- Midterm Exam (ME): weights as 1
- Final Exam (FE): weights as 2
- Average of Quizzes (Q): weights as 1

The final grade (FG) is obtained as follows:

$$FG = \frac{ME + 2 * FE + Q}{4}$$

VII. BIBLIOGRAPHY

- "Digital Electronics", Anil K. Maini. John Wiley & Sons, 2007.
- “Modern Digital Electronics 4th Edition”, Jain. Tata McGraw-Hill, 2010.
- “Digital Fundamentals”, Thomas L. Floyd, Prentice Hall 1999.