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

SYLLABUS - EE423 ELECTRONIC CIRCUITS III

I. GENERAL INFORMATION

CODE	**:**	EE423
SEMESTER	**:**	8
CREDITS	**:**	4
HOURS PER WEEK	**:**	5 (Theory – Practice)
PREREQUISITES	**:**	EE422 Electronic Circuits II
CONDITION	**:**	Compulsory
INSTRUCTOR	**:**	Carlos Medina, Ricardo Nunez

II. COURSE DESCRIPTION

This course make the student develop the skill to analyze and adopt important criteria for designing circuits switching and pulse circuits. Analyze performance RC network time with pulse excitation. Analyze main logic families' dynamic and static responses. Analyze and specify design criteria for multi-vibrator circuit and its applications. Analyze and explain criteria in analog-to-digital, digital-to-analog, voltage-to-frequency and frequency-to-voltage conversion methods. Analyze function-generator circuits. Analyze Timer 555 operation and design applications. Quantitatively and qualitatively analyze the analog and digital signal mixed processing such as PWM signals. Quantitatively and qualitatively analyze Phase-lock loop (PLL) circuits and its applications. Use simulation-specialized software.

III. COURSE OUTCOMES

1. Analyze fundamental concepts of analog and digital signal processing with positive feedback at in-detail circuit implementation level. Formulate criteria for the design, based on mathematics and physics foundations.
2. Analyze, implement and experience electronic circuits with direction to their integrated concept.
3. Computer-aidedly analyze and simulate the static and dynamic response of the implementation proposed as solution for usual conversion and interface circuits used in real application in fields of different control, instrumentation and telematics.
4. Use high level-mathematical and physical knowledge and computational techniques which allow explain and check solutions at studied-hardware level.

IV. LEARNING UNITS

1. CIRCUITS SWITCHING

RC network analysis in switching state / compensated-attenuation networks / Time analysis of RC-CI interaction network / SSI / Application exercises in wave conformers / Examples / Use of simulation software and results assessment.

2. LOGIC FAMILIES

Quantitative analysis of main logic families and static and dynamic parameters definition / comparative studies / Application analysis and exercises / Practical aspects in interfaces between different families / computer-aided simulation and results assessment, limitation identification.

3. MULTIVAIBRATORS

Definition and classifications / Quantitative analysis of various types of circuit implementation, experimental verification and comparative study with simulations results / Practical Application exercises / Compression evaluation of physically experimented circuits.

4. ADC, DAC, VFC, FVC CONVERTORS

Fundamental conditions in signal conversions, stage analysis / Analysis of main ADC and DAC conversion methods / Comparative studies and result assessment, Selection criteria for specific applications / Experimentation, analysis and discussion of results, simulations as assistance for the topic understanding / Examples of applications / Main VFC and FVC conversion methods analysis / Comparative studies and results evaluation, selection criteria for specific applications / Experimentation, analysis and discussion of results, simulations as assistance to the topic understanding / Examples of applications / Integrated applications.

5. TIMERS AND FUNCTIONS GENERATOR

Timer internal operation analysis, Application analysis, solution design for posed problems / Multiple-functions generator with variable parameters / Circuits experimentation / Circuits simulation and results comparative analysis, design criteria/ Exercises of application / Limitations assessment.

6. NONLINEAR APPLICATIONS OF INTEGRATED CIRCUITS

Operation analysis, applications analysis / Exercises, posed problems with specifications and variable parameters / Circuits experimentation, circuits simulation and results comparative analysis, design criteria / Exercises of application, limitation assessment.

7. PLL AND ITS APPLICATIONS

PLL Internal operation analysis, analysis of applications, Design of solutions for posed problems / Exercises with specifications and variable parameters / Circuits experimentation, Circuits simulations and results comparative analysis, design criteria/ Exercises of application, limitation assessment.

V. LABORATORY EXPERIENCES

The following laboratory experiences are carried out in the companion course EE443 Laboratory of Electronics III

- **Lab 1**: RC networks in circuits switching.
- **Lab 2**: Logic gates.
- **Lab 3**: Multivibrators I.
- **Lab 4**: Multivibrators II.
- **Lab 5**: Functions generator.
- **Lab 6**: Time-based generator.
- **Lab 7**: ADC converters I.
- **Lab 8**: ADC converters II.
- **Lab 9**: Ops and amps non-lineal applications.
- **Lab 10**: PLL applications.

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 hardware and software are used to studied solutions. At the end of the course the student must expose a paper complementing the sessions (It can be an integrated project, too). In all sessions student's active participation is encouraged through questions, case discussion and information search.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

PF = (EP + EF + (P1 + P2 + P3 + P4) / 4) / 3

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

VIII. BIBLIOGRAPHY

1. **SEDRA - SMITH**
   Microelectronics (Spanish)
   Oxford University Press Editorial, 2005.

2. **GRAY, P.**
   Analysis and Design of Analog Integrated Circuits
   John Wayle & Son Editorial, 2009