ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL
Faculty of Electrical and Computer Engineering
COURSE SYLLABUS
Linear Systems

1. CODE AND NUMBER OF CREDITS

CODE	FIEC05058	
NUMBER OF CREDITS : 4	**Theoretical: 4**	**Practical: 0**

2. COURSE DESCRIPTION

This course introduces general concepts related with the signal and systems analysis. It explores the mathematical methods for describing signals and systems in continuous and discrete time. The analysis of linear time invariant systems is emphasized in continuous and discrete time, using blocks diagrams. Several transformations (Laplace, Z, and Fourier) and the Fourier series are presented in order to analyze and determine the system respond in the frequency domain. This course displays the transformation application in filter design, communications systems, and feedback systems. Some workshops will be realized in groups for applying these techniques in day to day problems using MatLab.

3. PRE-REQUISITES AND CO-REQUISITES

PRE-REQUISITES	ICM01966 MULTIVARIABLE CALCULUS ICM01974 DIFFERENTIAL EQUATIONS
CO-REQUISITES	

4. CORE TEXT AND OTHER REQUIRED REFERENCES FOR THE TEACHING OF THE COURSE

CORE TEXT	1. V. Oppenheim, A. S. Willsky y I. T. Young, Signals and Systems. Segunda Edición, Prentice-Hall, 1997.
REFERENCES	1. R. E. Ziemer, W. H. Tranter y D. R. Fannin, Signals and Systems: Continuous and Discrete. Third Edition, Macmillan, 1989. 2. P. Lathi, Linear Systems and Signals. Berkeley-Cambridge Press, 1992

5. COURSE LEARNING OUTCOMES

At the end of the course, the student will be able to:

1. Present the basic concepts, theoretical elements, and mathematics formulations necessaries for analyzing the signal and continuous linear systems behavior in the time and frequency domain. The convolution, Fourier series, and Fourier transform are emphasized for ensuring the development and interpretation of the analysis
2. Understand the analog filter design basic concepts
3. Understand the signal and linear system processing for electrical engineering

6. COURSE PROGRAM

I. Signal and System modeling concepts (4 sessions - 8 hours)
- Continuous signals
- Independent variable transform
- Exponential and Sinusoid signals
- Delta and Step functions
- Continuous Systems
- System basic properties

II. System modeling and analysis in the time domain (4 sessions - 8 hours)
- LTI System continuous: convolution integral
- LTI System properties
- Causal LTI systems described by differential equations
- LTI systems respond to complex exponentials

III. Fourier Series (4 sessions - 8 hours)
- Continuous periodic signal representation
- Fourier series convergence
- Continuous Fourier series properties
- Fourier series and LTI systems

IV. Fourier Transform and its applications (4 sessions - 8 hours)
- Non periodic signals representation: Fourier continuous transform
- Periodic signals Fourier transform
- Fourier continuous transform properties
- Convolution property
- Multiplication property

V. Analog Filters (4 sessions - 8 hours)
- Fourier transform amplitude and phase representation
- LTI systems frequency respond amplitude and phase representation
- Ideal frequency selective filter properties in the time domain
- First and second order continuous systems

VI. Laplace Transformation and its application (4 sessions - 8 hours)
- Laplace transform
- Convergence region
- Laplace inverse transform
- Geometric Fourier transform evaluation from the "Poles and Zeros Diagram"
- Laplace transform properties
- Important Laplace transforms
- Unilateral Laplace transform

VII. Discrete time signal and system (4 sessions - 8 hours)
- Discrete signal and systems
- Discrete exponential and sinusoid signals
- Discrete LTI systems: convolution adding
- Causal LTI systems described by differential equations
- Discrete periodical signals represented using Fourier series
- Discrete Fourier series properties
- Non periodic signals representation: Discrete time Fourier transform
- Fourier transform for periodic signals
- Discrete time Fourier transform properties
- Convolution property
- Multiplication property

7. WORKLOAD: THEORY/PRACTICE

Sessions per week: two (2)
Hours per session: two (2) hours

8. CONTRIBUTION OF THE COURSE TO THE EDUCATION OF THE STUDENT

This course contributes to engineering with the signal and systems analysis. It captures the essence and beauty of the physical phenomenon, such as the important and useful science and engineering theories (Newton laws, Maxwell equations and Einstein theory). It also keeps the student in a permanent mathematical training and allows the abilities development

BASIC TRAINING	PROFESSIONAL TRAINING	SOCIAL SKILLS DEVELOPMENT
	X	

9. THE RELATIONSHIP BETWEEN THE LEARNING OUTCOMES OF THE COURSE AND THE LEARNING OUTCOMES OF THE DEGREE PROGRAM

LEARNING OUTCOMES OF THE DEGREE PROGRAM*	CONTRIBUTION (High, Medium, Low)	LEARNING OUTCOMES OF THE COURSE**	THE STUDENT MUST:
a) An ability to apply knowledge of mathematics, science and engineering	High	1	Analyze and resolve signal and system problems using science and engineering knowledge
b) An ability to design and conduct experiments, and to analyze and interpret data	Low		Design MatLab programs for analyzing system behavior

c) An ability to design a system, component or process to satisfy realistic constraints	High	2	Design, using block diagrams, discrete and continuous time systems
d) An ability to function on multidisciplinary teams	Low		Work with at least one partner for analyzing system respond
e) An ability to identify, formulate and solve engineering problems	Medium		Be able to design, analyze, and resolve any physical problem
f) An understanding of ethical and professional responsibility	Low		Identify and understand the ethical, legal and professional aspects of the developed applications
g) An ability to communicate effectively			
h) A broad education necessary to understand the impact of engineering solutions in a social, environmental, economic and global context			
i) A recognition of the need for, and an ability to engage in life-long learning	Medium		Keep the continuous development of his/her abilities
j) A knowledge of contemporary issues			
k) An ability to use the techniques, skills, and modern tools necessary for engineering practice	Medium		Implement proposed systems using Simulink and MatLab
l) Capacity to lead, manage and undertake projects			

10. EVALUATION IN THE COURSE

Evaluation activities	
Exams	X
Tests	X
Homework/tasks	X
Projects	
Laboratory/Experiments	
Class participation	X
Visits	
Other	X

11. PERSON RESPONSIBLE FOR THE CREATION OF THE SYLLABUS AND THE DATE OF ITS CREATION

Created by	Patricia Chavez MSEE
Date	22/Feb/2013

12. APPROVAL

ACADEMIC SECRETARY OF THE ACADEMIC DEPARTMENT	DIRECTOR OF TECHNICAL ACADEMIC SECRETARY
NAME: Mrs. Leonor Caicedo G.	NAME: Eng. Marcos Mendoza
SIGNATURE:	SIGNATURE: ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL
Date of approval by the Directive Council: 2013-537 2013-10-7	Ing. Marcos Mendoza V. DIRECTOR DE LA SECRETARIA TÉCNICA ACADÉMICA

13. VALIDITY OF THE SYLLABUS

RESOLUTION OF THE POLYTECHNIC BOARD:	13-12-343
DATE:	2013-12-12