A) COURSE

Course Id:	Course
5960	Applied Mathematics

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:		VI		III	IV
Course Type (Required/Elective)		Elective		Elective	Elective
Prerequisite Course:		Algebra B and Calculus D		Calculus D	Algebra B and Calculus D
CACEI Classification:		BS		BS	ES

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
Know and classify the signals and systems, as well as to identify its main characteristics and engineering applications. He will analyze and apply the theoretical fundaments of the Fourier Series and the theoretical basis of the Fourier Transform, Laplace Transform and Z Transform, their properties and limitations. The student will apply each of these transforms in the resolution of engineering problems.

D) TOPICS (CONTENTS AND METHODOLOGY)

1.-Signals and Systems.		**7 hours**
Specific Objective:	The student will classify signals and systems, and identify their applications in engineering.	

1.1 Classification of Signals. 1.1.1 Continuous and discrete signals. 1.1.2 Functions as signals. 1.1.3 Energy and Power of Signals. 1.1.4 Periodic signals. 1.1.5 Odd and Even Signals. 1.2 Special Types of functions. 1.2.1.Generalised Functions 1.2.2 Exponential Complex Functions. 1.3 Systems and their properties. 1.3.1 Continuous and discrete systems. 1.3.2 Memory Systems. 1.3.3 Invertibility and Inverse Systems. 1.3.4 Time-Invariant Systems. 1.3.5 Linear Systems.	
Readings and other resources	It is recommended to read the topics suggested in the bibliography. Perform application exercises.
Teaching Methodologies	It will be taught by expository sessions by the teacher.
Learning Activities	Research work, exercises done in class and tasks from the students are intended to broaden and deepen the themes and topics of the course.

2. Fourier series and their properties.	**12 hours**
Specific Objective:	The student will analyze and apply the Fourier Series and identify its importance in engineering.
2.1 Fundamental Properties. 2.1.1 Periodic functions and their properties. 2.1.2 Orthogonal Functions. 2.1.3 Basis of periodic functions. 2.2 Fourier Series. 2.3 Complex form of the Fourier series and Fourier Finite Series. 2.4 Conditions of Dirichlet. 2.5 The Parseval theorem. 2.6 Properties of Fourier Series. 2.6.1 Differentiation of Fourier Series. 2.6.2 Fourier Series of Odd and Even functions. 2.6.3 Half Wave Symmetry. 2.6.4 Quarter Wave Symmetry. 2.6.5 Hidden Symmetry.	
Readings and other resources	It is recommended to read the topics suggested in the bibliography. Perform application exercises.
Teaching Methodologies	It will be taught by expository sessions by the teacher.
Learning Activities	Research work, exercises done in class and tasks from the students are intended to broaden and deepen the themes and topics of the course.

3. Fourier and Laplace Transform.	**18 hours**
Specific Objective:	The student will develop and obtain the Fourier Transform and Laplace for continuous signals, as well as utilizing their properties in solving problems in engineering.

3.1 Fourier Transform. 3.1.1 Complex frequency spectrums. 3.1.2 Meaning and Deduction of the Fourier Transform. 3.1.3 Properties of the Fourier Transform. 3.1.3.1 Linearity. 3.1.3.2 Similarity Theorem or Escalation. 3.1.3.3 Translating time and frequency. 3.1.3.4 Transform the Derivative. 3.2 Laplace Transform. 3.2.1 Definition and sufficient conditions for existence. 3.2.2 The Laplace transform of Ele- mental functions. 3.2.3 The inverse Laplace transform. 3.2.4 Properties of the Laplace transform. 3.2.4.1 Linearity. 3.2.4.2 Escalation. 3.2.4.3 Behavior when s ∞. 3.2.4.4 Time and frequency translation. 3.2.4.5 Transform of periodic functions. 3.2.4.6 Derivatives and integrals of the Laplace Transform. 3.2.4.7 Initial and Final Value Theorem. 3.2.4.8 The convolution theorem. 3.2.5 Applications to calculate integrals. 3.2.6 Applications solvingTime-Invariant Linear Differential Equations. 3.2.7 Applications solvingTime-Variant Linear Differential Equations. 3.2.8 Applications solving Integral Equations.	
Readings and other resources	It is recommended to read the topics suggested in the bibliography. Perform application exercises.
Teaching Methodologies	It will be taught by expository sessions by the teacher.
Learning Activities	Research work, exercises done in class and tasks from the students are intended to broaden and deepen the themes and topics of the course.

4. The Z Transform. Properties and Applications.		**11 hours**
Specific Objective:	The student will develop and obtain the Z transform of discrete signals, as well as utilizing their properties.	
4.1 Background. 4.1.1 Series. 4.1.2 Convergence and Radius of Convergence. 4.2 The Z Transform. 4.3 The Z Transform of Elemental Functions. 4.4 Properties of the Z Transform. 4.4.1 Linearity. 4.4.2 Multiplication by a^k. 4.4.3 The Translation Theorem. 4.4.4 Complex Translational Theorem. 4.4.5 Initial and Final Value Theorem. 4.5 Solution of differential equations.		
Readings and other resources	It is recommended to read the topics suggested in the bibliography. Perform application exercises.	
Teaching Methodologies	It will be taught by expository sessions by the teacher.	
Learning Activities	Research work, exercises done in class and tasks from the students are intended to broaden and deepen the themes and topics of the course.	

E) TEACHING AND LEARNING METHODOLOGIES

a) The subjects are presented with traditional expositions.
b) In some sessions a general problem will be presented to the student and he will have to develop the solution analytically, and show some of their applications to related problems in engineering.
c) In other sessions a specific problem will be pose, and students will develop the solution analytically.
d) Continuously tasks will be asked that involve solving engineering problems.

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st. Partial Evaluation	16 sessions	Exam 90% , Tasks10%	1 y 2
2nd Partial Evaluation	16 sessions	Exam 90% , Tasks 10%	3
3rd. Partial Evaluation	16 sessions	Exam 90% , Tasks 10%	4
Final Ordinary Evaluation		100% (Average of the Partial Evaluations)	
Other activities:			
Extraordinary Exam	Week 17 of the semester in course	Exam 100%	Topics 100%
Title Exam	According to the schedule of the School Secretary	Exam 100%	Topics 100%
Regularization Exam	According to the schedule of the School Secretary	Exam 100%	Topics 100%

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

1. Hwei P. Hsu, Señales y Sistemas, 2a Edición, Mcgraw-Hill Interamericana, 2003.

2. Pablo Alvarado Moya, Señales y Sistemas. Fundamentos Matemáticos, Ediciones Centro de Desarrollo de Material Bibliografico, 2008.

3. B. P. Lathi, Linear Systems and Signals, 2a Edición, Oxford University Press, 2004.

4. Phil Dyke, An Introduction to Laplace Transforms and Fourier Series, 2a Edición, Springer Undergraduate Mathematics Series, 2014.

5. David W. Kammler, A First Course in Fourier Analysis, Cambridge University Press, 2007.

6. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Señales y sistemas, 2a Edición, Pearson Educación, 1998.

Complementary Books

1. Elias M. Stein y Rami Shakarchi, Fourier Analysis: An Introduction, Princeton University Press, 2003.

2. Won Y. Yang, Tae G. Chang, Ik H. Song, Yong S. Cho, Jun Heo, Won G. Jeon, Jeong W. Lee, Jae K. Kim, Signals and Systems with MATLAB, Springer-Verlag Berlin Heidelberg 2009.

3. Ogata, K., Ingeniería de Control Moderna. 5a Edición. McGraw-Hill. 2010.

4. Kuo B.C., Sistemas de Control Automático, 7a Edición, Prentice-Hall, 1996.

5. Dorf R. C., Bishop R. H., Sistemas de control moderno, 10a Edición, Pearson Educación, 2005.

6. Ogata, K., Sistemas de Control en Tiempo Discreto. 2ª. Edición. Prentice-Hall Inc. 1996.

Internet Links