

University of Puerto Rico
 Mayagüez Campus
 College of Engineering
 Department of Electrical and Computer Engineering
 Graduate Program in Electrical Engineering

Course Syllabus

1. General Information:	
Alpha-numeric codification: INEL 6049 Course Title: Multidimensional Signal Processing Number of credits: 3 Contact Period: 3 hours of lecture per week	
2. Course Description:	
English: Representation of multidimensional signals and systems; Fourier analysis of multidimensional signals; design and implementation of two-dimensional digital filters; applications of digital filtering techniques to beam forming and image analysis. Spanish: Representacion de Senales y Sistemas Multidimensionales; Analisis de Fourier de Senales Multidimensionales; Diseno e Implantacion de Filtros Digitales Bidimensionales; Aplicaciones de Tecnicas de Filtrosdigitales A la Formacion de Haces y Analisis de Imagenes.	
3. Pre/Co-requisites and other requirements:	
4. Course Objectives:	
After completing the course, the student should be able to: analyze discrete multidimensional signals and systems using the DFT, DTFT and Z transforms; design FIR and IIR discrete multidimensional filters; analyze discrete multidimensional signals using the DFT.	
5. Instructional Strategies:	
<input checked="" type="checkbox"/> conference <input checked="" type="checkbox"/> discussion <input type="checkbox"/> computation <input checked="" type="checkbox"/> laboratory <input checked="" type="checkbox"/> seminar with formal presentation <input type="checkbox"/> seminar without formal presentation <input type="checkbox"/> workshop <input type="checkbox"/> art workshop <input type="checkbox"/> practice <input type="checkbox"/> trip <input type="checkbox"/> thesis <input type="checkbox"/> special problems <input type="checkbox"/> tutoring <input type="checkbox"/> research <input type="checkbox"/> other, please specify:	
6. Minimum or Required Resources Available:	
7. Course time frame and thematic outline	
Outline	Contact Hours
1. Multidimensional Signals and Systems a. 2-D Discrete Signals. b. Multidimensional Systems. c. Frequency-domain characterization of signals and systems. d. Sampling continuous 2-D signals.	3
2. Discrete Fourier Analysis of Multidimensional Signals a. Multidimensional Discrete Fourier Transform.	6

b. Linear and Cyclic Convolution.	
3. Design and Implementation of 2-D FIR filters a. Implementation. b. Design using windows.	9
4. Multidimensional Recursive Systems a. Finite order difference equations. b. Multidimensional Z-transform and the concept of Stability.	6
5. Design and implementation of 2-D IIR filters a. Implementation. b. Design in state space and in the frequency domain	6
6. Applications in Image Processing a. Short-time Fourier Transform b. Beamforming c. Adaptive and Nonlinear Techniques d. Image Formation from Sensor Data	12
7. Exams	3
Total hours: (equivalent to contact period)	45

8. Grading System

Quantifiable (letters) Not Quantifiable

9. Evaluation Strategies

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	2	30
<input checked="" type="checkbox"/> Final Exam	1	15
<input checked="" type="checkbox"/> Short Quizzes	4	20
<input type="checkbox"/> Oral Reports	1	5
<input type="checkbox"/> Monographs		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Projects	3	20
<input type="checkbox"/> Journals		
<input type="checkbox"/> Other, specify: homework	10	10
TOTAL:		100%

10. Bibliography:

1. J. Woods, Multidimensional Signal, Image, and Video Processing and Coding, Elsevier Science & Technology Books, 2006
2. H. Schröder, H. Blume, One-and-Multidimensional Signal Processing: Algorithms and Applications in Image Processing, John Wiley, 2000.
3. Dan E. Dudgeon, Russell M. Mersereau, Multidimensional Signal Processing, 1984 (Classical textbook in the subject)
4. Alan C. Bovik, ed., Handbook on Image and Video Processing, Academic Press, 2000.
5. Alexandre Smirnov, Processing of Multidimensional Signals, Springer Verlag, 1999

11. According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Person who prepared this description and date of preparation:

Domingo Rodríguez, August 2007