Graduate Certificate in Digital Signal Processing

Introduction/Purpose

The Graduate Certificate in Digital Signal Processing (DSP) is designed to introduce students to the basic theory as well as the application of that theory and is particularly geared toward the distance education program, working engineers to expand their expertise in DSP.

Educational Objectives

The objectives of this program are:

- To provide technical professionals an opportunity to advance their careers through advanced education in DSP.
- To develop and improve relationships with the College of Engineering's constituencies by offering a program that addresses a known need for professional graduate-level development.
- To provide an opportunity for non-traditional students to consider advancing their education in areas that will foster their career development.
- To enable program students to become aware of current faculty research in these areas.

Market/Need

Our market is engineers and technical professionals who are interested in increasing their expertise in these important technical areas. We will use our current approach of marketing through our own internal mechanisms as well as the marketing resources available through the College of Extended Learning. We believe that this program may be marketed to students while they are undergraduates and then entered into after they have accepted employment. Since the major program focus will be distance-based, enrolment is not limited by a student's location. Additionally, the College of Engineering has strong employer relationships that may also be used to encourage students to enter this program. A key strategy is to encourage students to enter the certificate program and establish a grade point average that will allow them to apply for admission to the full master's program. Attached are letters of support that demonstrate the perceived need for this certificate program. Such letters indicate the intensity of interest by employers.

Advising

The advisor for this program is Professor Charles Creusere. He can be contacted by phone at 575-646-3919 or by email at ccreuser@nmsu.edu.

Admissions

Students applying to be admitted to the Digital Signal Processing Certificate Program must meet the same admissions criteria as students admitted into the Master of Science in Electrical Engineering. An undergraduate degree in electrical engineering with a GPA of 3.0 or higher is the norm. An undergraduate GPA as low as 2.5 will be considered. Students with undergraduate degrees in disciplines other than electrical engineering will be considered, provided they have completed the following undergraduate deficiency courses (or their equivalents):

Course Num & Credits	**Title**	**Catalog Description**
E E 210 4 credits	Engineering Analysis I	The application of linear algebra and matrices, probability, random variables and random processes to solve problems in electrical engineering. Applications to be covered include probabilistic modeling of electrical/electronic systems and an introduction to Mat lab. Prerequisite(s): C or better in EE 161 and MATH 192G.
E E 312 3 credits	Signals and Systems	Continuous-and discrete-time signals and systems. Time-and frequency-characterization of signals and systems. Transform-domain methods including Fourier-, Laplace-, and z-transforms. Prerequisite(s): C or better in EE 210, EE 280, and Math 392.
MATH 392	Introduction to Ordinary Differential Equations	Introduction to differential equations and dynamical systems with emphasis on modeling and applications. Basic analytic, qualitative and numerical methods. Equilibria and bifurcations. Linear systems with matrix methods, real and complex solutions. Prerequisite: C or better in MATH 192G or B or better in MATH 236.

Certificate-only seeking graduate students who are not currently enrolled in either a master's or doctoral degree program will be admitted into a separate classification such as "certificate graduate students." Students enrolled in certificate programs or who successfully complete a certificate program within a 5 year period and who wish to enter a related graduate degree program must re-apply to the degree program.

Students who are currently enrolled in a degree program at NMSU who wish to pursue an approved graduate certificate program must apply for admission to the certificate program prior to completing half of their required degree credits.

Transfer Credits

Students enrolled in certificate programs cannot transfer credits from another institution towards the completion of the certificate program offered by New Mexico State University. However, they can transfer credits taken in a certificate program of NMSU into a graduate degree program of the Klipsch School of Electrical and Computer Engineering, provided that a grade of B- or higher is earned in the course and the course logically fits into the student's program of study, as determined by their graduate advisor. There is no limit to the number of credits that can be transferred into a graduate program of the Klipsch School. The time limit on course transfer is 5 years after completion of the certificate.

Faculty Coordinator

The overall certificate program in Telemetering will be managed by Dr. Charles Creusere, Associate Professor Klipsch School of Electrical & Computer Engineering, current holder of the Frank Carden Chair in Telecommunications and Telemetering, ccreuser@nmsu.edu, 575-646-3919.

Core Faculty Supporting the Certificate Programs

- Dr. Charles Creusere
- Dr. Phillip Deleon
- Dr. Laura Boucheron

Multiple Certificates

Students would be allowed to earn multiple certificates, but they would not be allowed to count any one class towards multiple certificates. In the event that a student has already taken a class for one certificate that is required for a different one, that student would be allowed to substitute an elective class for the already-completed required class. Furthermore, it the student chooses to pursue a Masters degree at NMSU, the classes taken as part of our certificate programs will count towards this degree, subject to NMSU and graduate school requirements, of course.

Academic Content

A 3.0 minimum cumulative GPA in four courses as described below will be required for award of this certificate.

Required: (6 credits)
E E 545 Digital Signal Processing II
E E 571 Random Signal Analysis

Electives: (6 credits out of the following)
E E 565 Pattern Recognition
E E 573 Signal Compression
E E 589 Speech Processing
E E 594 Adaptive Signal Processing
E E 595 Multirate Signal Processing and Wavelets
E E 596 Digital Image Processing

Course Descriptions

E E 545. Digital Signal Processing II 3 cr.
Non-ideal sampling and reconstruction, oversampling and noise shaping in A/D and D/A, finite word length effects, random signals, spectral analysis, multirate filter banks and wavelets, and applications. Recommended preparation is E E 395 or equivalent.

E E 565. Pattern Recognition 3 cr.
Statistical pattern classification, supervised and unsupervised learning, feature selection and extraction, clustering, image classification and syntactical pattern recognition. Prerequisite: E E 571 or equivalent.

E E 571. Random Signal Analysis 3 cr.
Application of probability and random variables to problems in communication systems, analysis of random signal and noise in linear and nonlinear systems. Recommended preparation is E E 210 or equivalent.

E E 573. Signal Compression 3 cr.
Fundamentals of information source encoding and decoding. Includes information theory bounds on source coding, lossless coding algorithms, scalar quantizing and vector quantizing. Prerequisite: E E 571.

E E 589. Digital Speech Processing 3 cr.
Speech signals analysis, coding, enhancement, recognition, and synthesis; introduction to linguistics and the human auditory and production systems. Prerequisite: EE 545.

E E 594. Adaptive Signal Processing (s) 3 cr.
Wiener filters, linear prediction, least-mean-square algorithms, and recursive-least-squares algorithms with applications to prediction, system identification, equalization, and interference canceling. Prerequisites: E E 545 and E E 571.

E E 595. Multirate Digital Signal Processing and Wavelets 3 cr.
This class introduces material on multirate systems, multirate filter banks, wavelets, lapped orthogonal transformations, and lifting for fast implementations. Prerequisite: E E 395 or equivalent.

E E 596. Digital Image Processing 3 cr.
Two-dimensional transform theory, color images, image enhancement, restoration, registration, segmentation, compression and understanding. Prerequisite E E 571 or consent of instructor.