

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF ARMENIA

STATE ENGINEERING UNIVERSITY OF ARMENIA

CONFIRMED BY

EXECUTIVE DIRECTOR OF

“SYNOPSYS ARMENIA” CJSC SG

H. MUSAYELYAN

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VICE RECTOR OF STATE ENGINEERING

UNIVERSITY OF ARMENIA

R. AGHGASHYAN

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DIGITAL SIGNAL PROCESSING

COURSE PROGRAM

INDEX:

MIM-3.20

SPECIALIZATION **“VLSI DESIGN”**

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The program has been discussed and approved by:

- At the sitting of the SEUA interdepartmental Chair of **“Microelectronic Circuits and Systems”** acting on the basis of **“SYNOPSIS ARMENIA”** CJSC SG
Protocol No. 5 of 22.02.2005

Head of Chair
“Microelectronic Circuits and Systems”,
Associate Professor, PhD

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INTRODUCTION

Course program on “**Digital Signal Processing**” is assigned for postgraduate education on “**VLSI Design**” specialization and is taught on the 3rd semester (2 year’s 1st semester).

The course duration is 68 hours, lectures volume is 34 hours, and laboratory works are 34 hours.

COURSE GOALS AND OBJECTIVES

The goal of the course is to teach the students to the theoretical bases of digital signal processing, with the methods of description of discrete and digital signals and systems in the domain, z – and transform domain including discrete and fast Fourier transforms.

The main objectives of the course are:

The study of methods of design of digital filters.

In the process of the laboratory work it is necessary using Matlab program system, to investigate and design the digital filters.

SYLLABUS

1. LECTURES (34 hours)

1.1. Signal and signal processing (2 hours).

Classification of signals, examples of typical signals, signal applications.

1.2. Discrete signals in the time domain (4 hours).

Discrete time signals, the sampling process, characterization of linear time-invariant systems, random signals, correlation of signals.

1.3. Discrete signals in the transform domain (8 hours).

The Fourier transform, the discrete Fourier transform and its properties, linear convolution, the fast Fourier transform, the z-transform and inverse z-transform.

1.4. Linear time-invariant discrete systems in the transform domain (6 hours).

Finite dimensional discrete systems, the transfer function, simple digital filters, inverse systems, complementary transfer function, system identification, algebraic stability test, matched filter.

1.5. Digital processing of continuous-time signals (4 hours).

Sampling of continuous-time signals analog low pass filter design, design of analog high pass, band pass and band stop filters, analog - to - digital converter, digital - to - analog converter.

1.6. Digital filter structures (4 hours).

Block diagram representation, basic finite impulse response (FIR) digital filter structures, basic infinite impulse (IIR) response digital filter structures, all pass filters, IIR tapped cascaded lattice structure, FIR cascaded lattice structure, digital sine-cosine generator.

1.7. Digital filter design (6 hours).

Preliminary considerations bilinear transformation method of IIR filter design, design of low pass, high pass, band pass, band stop IIR digital filters, spectral transformations of IIR digital filters, spectral transformation of IIR filters, FIR filter design based on Windowed Fourier series, design of FIR digital filters with least-mean-square error.

2. LABORATORY WORKS (34 hours)

Tools used during laboratory works: Matlab.

- 2.1. Signal generation using Matlab. Sampling process (2 hours).
- 2.2. Discrete-time system and its classification (2 hours).
- 2.3. Output computation using Matlab. Correlation computation. Correlation computation of periodic signals (2 hours).
- 2.4. Discrete Fourier transformation computation using Matlab (2 hours).
- 2.5. Linear convolution (2 hours).
- 2.6. Discrete-time signals in the transform domain (2 hours).
- 2.7. z-transform and inverse z-transform using Matlab (2 hours).
- 2.8. Linear time-invariant systems in the transform domain (2 hours).
- 2.9. Fourier fast transform (5 hours).
- 2.10. Analog filter design using Matlab (2 hours).
- 2.11. Realization of basic filter structures using Matlab (3 hours).
- 2.12. Digital filters design using Matlab (4 hours).
- 2.13. Window-based filter design (4 hours).

METHODIC PROVISION OF THE COURSE

To study the course the necessary list of references is given below.

The course program is compiled taking into account that the following courses had been studied beforehand:

- “Mathematics”
- “Introduction to Circuits”
- “IC Design Introduction”
- “Analog Integrated Circuits”
- “Digital Integrated Circuits”

Understanding of the course is the basis for the further specialized subjects destined by the educational plan of “VLSI Design” specialization.

REFERENCIES

Main

1. Sanjit K. Mitra. Digital signal processing, 2001.
2. A. I. Solonina and others. The bases of digital signal processing, S. Petersburg, 2003. (in Russian).

Additional

3. A. B. Sergienko, - “Digital signal processing”, M. 2002, (in Russian).

4. L. R. Rabiner, B. Gold. Theory and application of digital signal processing. Prentice-Hall, New Jersey, 1975.