Rutgers University, Department of Electrical and Computer Engineering
ABET COURSE SYLLABUS
COURSE: 14:332:348

Course Catalog Description: 14:332:348 – Digital Signal Processing Laboratory (1)
To carry out software and hardware experiments illustrating the basic principles and techniques of digital signal processing and to illustrate some concrete applications, such as filtering for noise reduction and digital audio effects.

Pre-Requisite Courses: 14:332:345, 01:640:244

Co-Requisite Courses: 14:332:346

Pre-Requisite by Topic:
1. Linear time-invariant systems
2. Convolution and transfer functions
3. Laplace transforms and z-transforms
4. Difference equations
5. Programming in C and MATLAB

Textbook & Materials:
S.J. Orfanidis, Digital Signal Processing Laboratory Manual
S.J. Orfanidis, ADSP-2181 Experiments

References: *MatLab: Student Version*, Current Edition, The MathWorks, Inc..

Overall Educational Objective: To introduce the basic principles, methods, and applications of digital signal processing, emphasizing its algorithmic, computational, and programming aspects.

Course Learning Outcomes: A student who successfully fulfills the course requirements will have demonstrated:

1. Ability to program digital signal processing algorithms in C and MATLAB, including simulating the operation of A/D and D/A converters and the design, implementation, and operation of digital filters.

2. Ability to program a DSP chip with a variety of DSP algorithms, such as implementing digital audio effects or notch filters for noise reduction.

How Course Outcomes are Assessed:
Laboratory software and hardware reports (100%)

N = none S = Supportive H = highly related

Outcome	Level	Proficiency assessed by
(a) an ability to apply knowledge of Mathematics, science, and engineering	H	Laboratory work and reports
(b) an ability to design and conduct experiments and interpret data	S	Laboratory work and reports
(c) an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	S	Laboratory work and reports
(d) an ability to function as part of a multi-disciplinary team	N	
(e) an ability to identify, formulate, and solve ECE problems	H	Laboratory work and reports
(f) an understanding of professional and ethical responsibility	N	
(g) an ability to communicate in written and oral form	S	Laboratory work and reports
(h) the broad education necessary to understand the impact of electrical and computer engineering solutions in a global, economic, environmental, and societal context	N	
(i) a recognition of the need for, and an ability to engage in life-long learning	S	Laboratory work and reports

(j) a knowledge of contemporary issues	N	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for electrical and computer engineering practice	H	Laboratory work and reports
Basic disciplines in Electrical Engineering	H	Laboratory work and reports
Depth in Electrical Engineering	S	Laboratory work and reports
Basic disciplines in Computer Engineering	H	Programming DSP algorithms in C, MATLAB, and assembly language for DSP chips
Depth in Computer Engineering	S	Software and hardware programmin
Laboratory equipment and software tools	H	Analog Devices DSP-2181 digital signal processor. Programming in C, MATLAB, and DSP software development environment
Variety of instruction formats	S	Lecture followed by lab time

Topics Covered week by week:
Week 1: Introduction.
Weeks 2 and 3: Sampling, quantization, and DSP data formats.
Weeks 4 and 5: FIR filtering and convolution.
Weeks 6 and 7: Filtering of noisy signals.
Week 8: ADSP2181 chip architecture and instruction set.
Week 9: ADSP2181 – delays and FIR filters.
Weeks 10 and 11: Spectral analysis by DFT/FFT.
Week 12: ADSP2181 - reverb filters, multitap delays, guitar algorithms.
Week 13: ADSP2181 - notch filters.
Week 14: Review

Computer usage: DSP algorithm programming in C, MATLAB, and Assembly Language**.**

Laboratory Experiences: There are eight two-period laboratory sessions. Four sessions are software experiments selected each year from a list. The software sessions meet every two weeks. Four laboratory sessions are hardware experiments using the ADSP 2181 processor. The hardware sessions meet every week.
Equipment used: 1. Solaris and windows based PCs, GCC or Borland C compilers and MATLAB.
2. Analog Devices Ez-kit Lite DSP board, based on the ADSP-2181 digital signal processor.

Design Experiences: Some of the labs involve the design of digital filters using MATLAB, and their implementation and testing in software and hardare on a DSP chip.

Independent Learning Experiences: 1. Writing laboratory reports, 2. Conducting MATLAB simulations, 3. Conducting hardware experiments on a DSP chip.

Contribution to the Professional Component:
(a) College-level mathematics and basic sciences: 0.5 credit hours
(b) Engineering Topics (Science and/or Design): 0.5 credit hours
(c) General Education: 0 credit hours
Total credits: 1

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