

Department of Electronics, Computer and Communications Engineering  
School of Science and Engineering  
Ateneo de Manila University  
Second Semester, 2003-2004

### CE 101: **Techniques in Signal Processing** (3 units)

Additional information on this course shall be made available at

*[http://www.geocities.com/lui\\_agustin/dsp](http://www.geocities.com/lui_agustin/dsp)*

as the semester progresses. Students are expected to regularly check this site for updates.

CE 101 A: TTh, 0730 - 0900, F310

CE 101 B: TTh, 0900 - 1030, F310

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*[http://www.geocities.com/lui\\_agustin](http://www.geocities.com/lui_agustin)*

consultation hours: MWF, 0830 – 1000, F311/F312

#### **1. Course Description**

This is an introductory course on digital signal processing (DSP) for computer engineering majors that gives equal emphasis on theory and applications. Topics include analog to digital conversion, Z-transform and its application to the analysis and implementation of linear time invariant systems, frequency analysis of discrete time signal using the discrete Fourier transform, design of digital finite impulse response (FIR) filters, and transformation of analog filters to digital infinite impulse response (IIR) filters. Concepts learned in lectures are reinforced through programming exercises and real-time processing with Texas Instruments' DSP units.

Prerequisite: 5th year standing

#### **2. Textbook**

John Proakis and Dimitris Manolakis, Digital Signal Processing, 3rd ed, 1996.

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#### 3. Course Timeframe

CE 101 Timetable, 2nd Semester, 2003-2004

Week		Tuesday	Thursday
1	Nov		13 Intro to DSP
2		18 DSP Architecture  deadline for applying for use of DSP Lab	20 problem set 1: exer 1.5, 1.9, 1.10, 1.11, 1.15 pp 40-42 (study Chap 1)  11 am: deadline for priority list for past project to report on
3		25 evaluation of lab exercise 1: Delay Program (F311)	27 reports on past projects
4	Dec	2 reports on past projects	4 reports on past projects
5		9 problem set 2: exer 2.2, 2.20, 2.22, 2.30, 2.31c pp 135-141 (study sec 2.1 to 2.4)  11 am: draft project proposals due sign up for consultations	11 problem set 3: exer 2.33, 2.44, 2.46, 2.47, 2.58 pp 142-147 (study sec 2.4 to 2.7)
6		16 evaluation of lab exercise 2: Digital Sinusoidal Oscillators (F311)	18 problem set 4: exer 3.6, 3.12, 3.16, 3.23, 3.30 pp 221-224 (study sec 3.1 to 3.4)  11 am: approved project proposals due
7	Jan	6 problem set 5: exer 3.34, 3.43, 3.45, 3.46, 3.48 pp 224-227 (study sec 3.4 – 3.7)	8 first exam  11 am: progress report 1 due
8		13 evaluation of lab exercise 3: A Digital Sinusoidal Oscillator on the 'C542 (F311)	15 reports on project progress  11 am: progress report 2 due
9		20 problem set 6: exer 4.10, 4.18, 4.24, 4.28, 4.30 pp 370-376 (study sec 4.1 to 4.4)	22 reports on project progress  11 am: progress report 3 due
10		27 evaluation of lab exercise 4: DTMF Tone Generation (F311)	29 reports on project progress 1030: sign up for pre-final project evaluation 11 am: progress report 4 due
11	Feb	3 problem set 7: exercises 4.35, 4.43, 4.51, 4.56, 4.60 pp 377-383 (study sec 4.4 to 4.5)	5 reports on project progress  11 am: progress report 5 due
12		10 evaluation of lab exercise 5: Magnitude Response (F311)	12 pre-final project evaluation (Feb 11, 12, 13)  sign up for final project evaluation
13		17 problem set 8: exer 4.67, 4.68, 4.82, 4.86, 4.92 pp 385-390 (study sec 4.4 to 4.5)	19 second exam
14		24 CE 101 project defense (Feb 24-27)	26

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### **4. Course Requirements**

- \* one project
- \* problem sets
- \* two exams
- \* lab exercises

Lectures and class discussions based on the problem sets cover the basic theory of DSP, while the lab exercises cover more practical aspects of DSP. The exams mostly cover material related to the problem sets that precede them, but may include questions related to the lab exercises. The project component orients part of the course towards research.

#### **4.1. Problem Sets and Exams**

The timetable identifies problem sets for you to do. These problem sets cover material from chapters 1 to 4 of the textbook.

You are expected to have done the problem set assigned for a particular day when coming to class on that day. You are not required to submit problem sets. You will not be penalized for doing them wrong. You are required to do them.

Bonus points will be given to those who submit correct answers to exercises in the problem sets under the following conditions:

- \* the exercise was done correctly; solutions and computations must be sufficiently detailed
- \* only the first correct solution of a given exercise gets bonus points
- \* the answer must be printed –NOT handwritten-- on short bondpaper, and must not have any erasures
- \* the exercise must be submitted either by an individual or a group of at most four
- \* the exercise must have been submitted by 11 am of the school day prior to the day for which the exercise was assigned; Saturdays, Sundays, and holidays shall not count as school days.

Two bonus points will be given if the exercise was submitted by an individual. N+1 bonus points will be given if the exercise was submitted by N students. In this case the N+1 points will be equally distributed among the N students. Bonus points are added directly to the class standing.

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Demerits will be given to those who come to class without having done the problem set. One demerit is given for the first offense, two demerits for the second, three for the third, and so on. Demerits are subtracted directly from the class standing.

The exams mostly cover material related to the problem sets that precede them, but may include questions related to the lab exercises. Each exam will have 5 items, each graded over 10 points. The normalized exam score is twice the number of points earned.

#### **4.2. Lab Exercises**

There will be five lab exercises. These exercises will be checked in the DSP Lab during class hours on the dates indicated in the course timetable. They should be done before the indicated dates.

Details regarding lab exercises are typically posted on the course website about a week before they are due.

Each lab exercise shall be graded over 10 pts. The normalized lab grade (normalized to 100 points) is computed as 10 times the average of the lab exercise scores. The normalized lab grade shall comprise 30% of the Basic Class Standing.

#### **4.3. DSP Project**

The DSP project requires work on some aspects of DSP beyond the basic requirements of the course.

The 100-pt normalized project grade is distributed as follows:

report on a past project	5
formulation of a draft proposal	5
approved proposal	5
progress reports	10
project progress presentation	5
pre-final project evaluation	10
final project evaluation	60
total	<u>100</u>

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The next few sections provide details on some aspects of the project. Additional information shall be provided on the course website.

#### **4.3.1. Report on a Past Project**

The report shall be on one of the projects from CE 101 in 2nd sem of 2002-2003 or ELC 152 in 1st sem of 2003-2004. Study these past projects and submit a priority list of 3 or more projects you prefer to present, in decreasing order of preference. As much as possible you will be assigned a project that is on your list. No project will be assigned to you if no priority list is submitted by the deadline indicated in the course timetable, in which case 5 pts in the normalized project grade shall be forfeited.

#### **4.3.2. Project Proposal**

The purpose of the project proposal is to set definite goals. As a minimum, the project proposal must give as detailed a description as possible of the work to be done and the expected output. An introduction and background information may help to provide some context for the proposed work. A statement of the methodology and a timetable should be included as much as possible.

#### **4.3.3. Progress Reports**

Five progress reports are required, each one corresponding to 2 pts in the normalized project grade.

Progress reports must be submitted individually, and must provide details about an individual's work on the project since the last progress report, or since the start of the project. Progress reports shall be limited to one page. Progress reports exceeding one page get no credit.

Progress reports shall be accepted starting at 11 am of the day before they are due.

A progress report earns either 0, 1, or 2 pts in the normalized project grade. No points are earned if very little detail is given regarding an individual's work, or if the work done is deemed insignificant. One point is earned if the work is deemed insufficient, or if the report merely describes the group's efforts, but makes very little mention of an individual's contribution.

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#### **4.3.4. Project Policies**

All projects shall use opensource software and/or freeware whenever possible. In particular, the use of software such as Matlab, and Microsoft Visual Basic and Visual C++ shall be prohibited.

Project documentation shall be in openoffice format.

Projects submitted late by 24 hours or less shall be penalized 20 pts in the normalized project grade. Projects late by more than 24 hours shall be penalized 40 pts in the normalized project grade.

All projects submitted become the property of the Department of ECCE.

#### **5. Grading System**

The basic class standing is computed as

$$BCS = 30\% L + 30\% E + 40\% P$$

where

L is your performance in lab exercises,

E is the average of your exams, and

P is your project grade, with L, E, and P all normalized to 100 points.

The class standing (CS) is computed as

$$CS = BCS + B - D,$$

where

B is the number of bonus point earned, and

D is the number of accumulated demerits.

The final grade (FG) will be determined from the class standing (CS) as follows:

$$\begin{array}{ll} FG = F & \text{if } CS < 50, \\ D & \text{if } 50 \leq CS < 60, \\ C & \text{if } 60 \leq CS < 69, \\ C+ & \text{if } 69 \leq CS < 77, \\ B & \text{if } 77 \leq CS < 86, \\ B+ & \text{if } 86 \leq CS < 92, \\ A & \text{if } 92 \leq CS. \end{array}$$

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Your instructor has the prerogative of giving a higher grade than that determined from the class standing.

Demerits are points deducted from your class standing for offenses against the conduct of the course. These offenses include, but are not limited to:

- \* failure to contribute to class discussion
- \* failure to do problem sets
- \* disrupting class discussion
- \* speaking out of turn in class
- \* doing work unrelated to CE 101 during class time
- \* violations of DSP Lab rules
- \* disturbing someone during an exam

One demerit is given for the first time an offense is committed. Successive offenses of the same nature shall be awarded two demerits, three demerits, and so on.

#### **6. Class Policies**

##### **On attendance**

Attendance may or may not be checked on a given class day. Attendance may be checked at any time during class. If attendance is checked, absence from class at the time attendance is checked shall be considered a cut.

##### **On coursework in general**

All handwritten work must be accomplished using blue or black ink. Only the front of each sheet of paper should be used. No credit shall be given for anything written at the back nor for anything not written in ink.

Only the following paper may be used in exams, quizzes, and homework:

- \* white intermediate pad paper
- \* white short bond paper
- \* white long bond paper
- \* yellow pad paper.

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**On exams**

Students taking exams are required to bring 20 sheets of paper, and two pens. Students who do not have these will not be allowed to take the exam.

Exams must be accomplished using blue or black ink. Only the front of each sheet of paper should be used. No credit shall be given for anything written at the back nor for anything not written in ink.

All exams shall be "open books, open notes" exams, except for make-up exams.

Make up exams shall be taken with closed books and notes, regardless of the nature of the regular exam. Exemptions to this rule are possible only in extreme circumstances, and subject to the discretion of your instructor.

Answers to exam questions must be arranged in sequence and exam papers stapled together on the upper left hand side, when they are submitted. 20 points shall be deducted from the normalized exam score if answers are not arranged in sequence. 20 points shall be deducted from the normalized exam score if the exam papers are not stapled together on the upper left hand side. The exam score shall be 0 if these deductions result in a negative score.

Each exam will have the same weight in the final grade. There are no exemptions from any exam. No exam will be cancelled in computing the final grade.