Syllabus – Digital Signal Processing

Kode Mata Kuliah (*Course Code*): TIF208	**Nama Mata Kuliah** (*Course Name*): Digital Signal Processing		
Program Studi (*Study Program*): **Informatics**	**Fakultas** (*Faculty*): **Engineering and Computer Science**		
Mata Kuliah Pra-Syarat (*Course Pre-requisite*): **Calculus 1–2, Linear Algebra**	**Kredit** (*Credit*): **3**		
	Kuliah (*Lecture*): **3**	**Tutorial**: –	**Praktikum** (*Practicum*): –
Revisi (*Revision Status*): **2.0**	**Semester**: Genap/Even **Tahun Akademik**: 2015/2016		
Lecturer's Name: Irwan Prasetya Gunawan			

COURSE DESCRIPTION

This course provides a fundamental understanding of signal processing in a discrete-time system (digital) domain that can be done in the time (by performing various operations on the signal including convolution and correlation) or in the frequency domain, as well as providing knowledge of discrete-time systems analysis, synthesis and implementation including digital filter design through various methods.

COURSE OBJECTIVES

Upon completion of this course, the student should be able to:

- Understand the concepts of discrete-time signals and systems
- Apply transform method and their inverse to signals
- Have knowledge on digital filters and their realisation
- Understand and recognize issues in sampling and reconstruction
- Know about DFT and its fast computation
- Apply frequency domain analysis using DFT
- Understand the fundamental algorithms and structures used in DSP computation
- Design and code DSP applications in a high-level language
- Review state-of-the-art DSP R&D

METHODS OF INSTRUCTIONS

Classroom instruction consists of lectures and practical problem solving, supplemented by visual aids designed to assist the student to successfully meet the course's learning objectives.

It is imperative that students take an active interest in the course. To succeed in this course, students must read, think, and write in a critical and analytical manner and this takes time and practice. Such practice can only be achieved by working exercises. When troubles arise, and they will, the student must ask questions which may be directed to the instructor or other students in a variety of ways.

Students are also encouraged to work together on problem sets as part of their exercises. However, individual must ultimately demonstrate the understanding of the material by writing up his/her own solutions without the help of other students or their written work.

On average students need to spend roughly, at least, 9 hours of study and preparation per week for this course.

ATTENDANCE REQUIREMENT

Comply with academic rules. Punctuality and regular attendance in classes is of prime importance for successful completion of this course. Students will be expected to arrive for class on time and to remain in class until the end of the class session.

Absence from lectures shall not exceed 22%. Students who exceed the 22% limit without a medical or emergency excuse acceptable to and approved by the Dean of the Faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course.

ASSESSMENT

Coursework evaluation will be weighted as follows:

- Mid Semester Test: 30%
- Final Semester Test: 40%
- Others (class participation, Assignments/quiz/pretest): 30%

MATERIAL REFERENCES AND REQUIRED SUPPLIES

Textbooks:

[1] Jonathan Stein, "Digital Signal Processing: A Computer Science Perspective", John Wiley & Sons, 2000

[2] Steven Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing. Downloadable at http://www.dspguide.com/pdfbook.htm

Supporting reading materials:

- Emmanuel C. Ifeachor and Barrie W. Jervis, "Digital Signal Processing: A Practical Approach", Prentice-Hall, 2002
- Sanjit K. Mitra and James F. Kaiser, "Handbook for Digital Signal Processing", John Wiley & Sons, 1993
- PA Lynn and W Fuerst, "Introductory Digital Signal Processing with Computer Applications", Revised Edition, John Wiley & Sons, 1994
- MIT OpenCourseWare[1], 2005.

Supporting tools:

- Matlab or Octave – http://octave-gtk.sourceforge.net
- Python – http://python.org
- Audacity – http://www.audacityteam.org

COURSE OUTLINE

Note: all materials are delivered by means of in-class lectures and class room discussions. Chapters in the references refer to [1].

Session	Topics & Sub-Topics	Methods	References	Assignment
1	Introduction to DSP (a) Course manifest (b) Syllabus explanation (c) Overview to DSP (d) Review: complex numbers (e) General Introduction to Signals & systems	Lecture, Discussion, Assignment	Chapter 1	Problems: 1.2.4, 1.3.4, 1.4.2, 1.4.4, 1.4.6
2	Signal representations (a) Signal plotting (b) Signal functions (c) Odd and even functions (d) Operations on signals	Lecture, Discussion	Chapter 2.1-2.5	Probs: 2.1.2, 2.2.3, 2.2.5, 2.2.7 (for sinc function only), 2.3.3
3	Discrete Time Signals Introduction (a) Review: continuous time signals (b) Discrete time signals	Lecture, Discussion, Quiz	Continued	Probs: 3.3.2, 3.4.1
4	Basic signals (a) Impulse signals (b) Unit step (c) Exponential signals (d) Complex sinusoidal (e) Discrete periodic signals	Lecture, Discussion	Chapter 2.6, 2.7, 2.8	Probs: 2.4.6, 2.5.3, 2.5.4, 2.6.4, 2.9.2

[1] http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-341Fall-2005/

5	Systems (a) Systems Classifications (b) Static v Dynamic (c) Causal v Non-Causal (d) Linear v Non-Linear (e) Time Invariance v Time Varying	Lecture, Discussion	Ch. 6.1, 6.2, 6.4	Problems 6.1.1, 6.4.1, 6.4.3, 6.4.6
6	System (cont'd): (a) block diagram (b) graph theory (c) LTI system	Lecture, Discussion	Ch. 6.3	Problems: 6.3.1, 6.3.7
7	Convolution sum (a) Basic concept (b) Array algorithm (c) Polynomial multiplication method (d) Use of convolution in LTI system	Review, Discussion, Quiz	Chapter 1, 2, 6	–
MID SEMESTER TEST				
8	Fourier Transform	Review, Discussion	Ch. 4.1-4.3, 3.6	Probs: 4.1.2, 4.1.3, 4.2.2, 4.3.3, 3.6.1
9	DFT, FFT Algorithm	Lecture, Discussion	Ch. 4.7, 4.17, 14.1-14.2	Probs: 4.7.1, 4.7.5, 4.17.1, 4.17.3, 14.1.1, 14.2.2, 14.2.3
10	Z Transform	Lecture, Discussion	Ch. 4.10-4.11	Probs: 4.10.1, 4.10.3, 4.11.2, 4.11.5
11	Transfer function, pole-zero plot	Lecture, Discussion, Quiz	Ch. 6.14, 7.6	Probs: 6.14.3, 6.14.5, 7.6.5, 7.6.7, 7.6.9
12	Filters: (a) MA filters (b) ARMA filters (c) Filters specification (d) Design	Lecture, Discussion	Ch. 6.7, 6.9-6.10, 7.1	Probs: 6.7.1, 6.7.5, 6.9.2, 6.9.3, 6.10.5, 7.1.3
13	Systems identification	Lecture, Discussion	Ch. 6.12, 6.13	Probs: 6.12.2, 6.12.3, 6.13.4, 6.14.5
14	Applications (a) Digital communications (b) Speech applications (c) Compression	Lecture, Review, Discussion, Quiz	Ch. 11.3, 11.4, 17, 18 , 19.1, 19.6, 19.8	See chapter problems
FINAL SEMESTER TEST				

Prepared by:
Name: Irwan Prasetya Gunawan
Position: Lecturer
Date: April 10, 2016

Certified by:
Name: Hoga Saragih
Position: Head of Department
Date