TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

DIGITAL SIGNAL PROCESSING

by

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UNIVERSITAS INDONESIA
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
PHYSICS UNDERGRADUATE STUDY PROGRAM

TEACHING INSTRUCTIONAL DESIGN

Course Name	Digital Signal Processing	**Credit(s)**	**Prerequisite course(s)**	**Requisite for course(s)**	**Integration Between Other Courses**
Course Code	SCPH604708	4	Modern Physics, Mathematical Physics 2, Electronics 2	-	-
Relation to Curriculum	-				
Semester	7				
Lecturer(s)	Adhi Harmoko Saputro, Ph.D.				
Course Description	*After completing this lecture, physics students with a special interest in systems and physics instrumentation in semester 7 are able to analyze (C4) digital signals in the discrete time domain and discrete frequency and apply (C3) the concept of transformation for digital filter applications appropriately. The language of instruction used in this course is Indonesian.*				

Program Learning Outcome (PLO)

PLO	Describing contemporary and current phenomena, findings, physics topics.

PLO	Build insights into the latest developments in science and technology related to physics.
PLO	Applying physics in the production process.
PLO	Apply knowledge of physics in society and practical life.
PLO	Recommends the need for a physical instrumentation system.
PLO	Assisting research in the field of systems and physical instrumentation.
PLO	Solve simple problems related to physics instrumentation and systems.
Course Learning Outcome (CLO)	
CLO	Students are able to analyze (C4) digital signals in the discrete time domain and discrete frequency and apply (C3) the concept of transformation for digital filter applications appropriately.
Sub-CLO	
Sub-CLO 1	Be able to apply (C3) basic electronic concepts for signal conditioning.
Sub-CLO 2	Able to apply (C3) mathematical physics concepts to the digital signal transformation method.

Sub-CLO 3	Able to analyze (C4) digital signals in discrete time and frequency domains using the Fourier transform method.
Sub-CLO 4	Be able to apply (C3) the concept of digital filters for linear time-invariant (LTI) systems.
Study Materials	• Signal and system recognition • ADC and DAC signal conversion • Discrete time systems and signals • Z transformation • Continuous time signal sampling • Application of the Z transformation for time-invariant linear (LTI) systems • Continuous time signal frequency analysis • Discrete time signal frequency analysis • Fourier transform for discrete time signals • Fourier analysis for discrete time signals • Filter concept • Finite Impulse Response (FIR) digital filter • Infinite Impulse Response (IIR) digital filter
Reading List	• Kehtarnavas, N., *Digital Signal Processing System Design: LabVIEW-Based Hybrid Programming*, Academic Press, 2008. • Ingle, V.K., and Proakis, J.G., *Digital Signal Processing using Matlab*, Cengage Learning, 4th Ed., 2012. • Oppenheim, A.V. and Schafer, R.W., *Discrete-Time Signal Processing* (3rd Ed), Prentice Hall, 2009.

Teaching Plan

Week	Sub-CLO	Study Materials [with reference]	Teaching Method [with est. time]	Learning Experiences (*O-E-F)	Sub-CLO Achievement Indicator		Sub-CLO Weight on Course (%)
					General	Specific	
1	Introduction						
2	1	• Introduction to signal and digital systems [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Able to describe digital signals and systems, especially linear time-invariant (LTI) systems.	Able to analyze linear time-invariant (LTI) systems in electronics	8.33%
3	1	• ADC and DAC signal conversion [Reference]	Interactive lectures, question-based learning, self-directed study, discussion	Orientation: Introduction to this week's topic (20%)	Be able to explain how to convert ADC and DAC signals	Able to apply ADC and DAC conversion methods for	8.33%

		Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	[Estimated time] 100x2 minutes	Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)		electronic systems.	
4	1	• Discrete time systems and signals [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Be able to explain discrete time systems and signals and their differences continuously.	Able to analyze discrete time systems and signals	8.33%

5	2	• Z transformation [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Be able to explain the Z transformation method	Be able to use the Z transformation in a linear time-invariant (LTI) system.	8.33%
6	2	• Continuous time signal sampling [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback:	Be able to explain the continuous time signal sampling method	Able to process continuous time signal byproducts	8.33%

				Question and answer with the lecturer (20%)			
7	2	• Application of the Z transformation for linear time-invariant (LTI) systems [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Be able to explain the use of the Z transformation for a linear time-invariant (LTI) system.	Be able to apply the Z transformation for linear time-invariant (LTI) system analysis.	8.33%
8				Mid Term Exam			
9	3	• Continuous time signal frequency analysis [Reference]	Interactive lectures, question-based learning, self-directed study, discussion	Orientation: Introduction to this week's topic (20%)	Be able to explain the continuous time signal frequency analysis method	Able to apply continuous time signal frequency analysis method	6.25%

		Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	[Estimated time] 100x2 minutes	Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)			
10	3	• Discrete time signal frequency analysis [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Be able to explain discrete time signal frequency analysis method	Able to apply discrete time signal frequency analysis method	6.25%
11	3	• Fourier transform for discrete time signals	Interactive lectures, question-based	Orientation:	Be able to explain the	Be able to apply Fourier	6.25%

		[Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	learning, self-directed study, discussion [Estimated time] 100x2 minutes	Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Fourier transform principle for discrete time signals	transforms to discrete time signals	
12	3	• Fourier analysis for discrete time signals [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback:	Be able to explain the methods and results of Fourier analysis for discrete time signals	Able to analyze discrete time signals using the Fourier method	6.25%

				Question and answer with the lecturer (20%)			
13	4	• Filter concept [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Be able to explain the basic principles of filters for digital systems	Able to apply the basic principles of filters in digital system design	8.33%
14	4	• Finite Impulse Response (FIR) digital filter [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise:	Able to explain FIR type digital filter	Able to design FIR-type digital filters	8.33%

				Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)			
15	4	• Infinite Impulse Response (IIR) digital filter [Reference] Oppenheim, A.V. and Schafer, R.W., Discrete-Time Signal Processing (3rd Ed), Prentice Hall, 2009.	Interactive lectures, question-based learning, self-directed study, discussion [Estimated time] 100x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Be able to explain the IIR type digital filter	Able to design IIR type digital filters	8.33%
16	Final Exam						

RANCANGAN TUGAS DAN LATIHAN

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
2-7, 9-15	Individual Assignment	SUB-CLO 1-4	Work on homework	• Signal and system recognition	Home work	1 week	Answers uploaded on EMAS
8	Mid term exam	SUB-CLO 1-2	Work on problems	• Signal and system recognition • ADC and DAC signal conversion • Discrete time systems and signals • Z transformation • Continuous time signal sampling • Application of the Z transformation for time-invariant linear (LTI) systems	Working on Mid term exam in EMAS	100 minutes	Answers uploaded on EMAS

16	Final exam	SUB-CLO 3-4	Work on problems	• Continuous time signal frequency analysis • Discrete time signal frequency analysis • Fourier transform for discrete time signals • Fourier analysis for discrete time signals • Filter concept • Finite Impulse Response (FIR) digital filter Infinite Impulse Response (IIR) digital filter	Working on Final exam in EMAS	100 minutes	Answers uploaded on EMAS

Assessment Criteria

Evaluation Type	Sub-CLO	Assessment Type	Frequency	Evaluation Weight (%)
Individual Assignment	1-4	Summary or Homework	1 per week	30
Mid term exam	1-2	Exam questions at EMAS UI	1 per week	35
Final exam	3-4	Exam questions at EMAS UI	1 per week	35
Total				**100**

Pedoman Kriteria Penilaian

Konversi nilai akhir mahasiswa berdasarkan ketentuan yang berlaku di Universitas Indonesia. Konversi nilai tersebut adalah:

Nilai Angka	Nilai Huruf	Bobot
85—100	A	4,00
80—<85	A-	3,70
75—<80	B+	3,30

70—<75	B	3,00
65—<70	B-	2,70
60—<65	C+	2,30
55—<60	C	2,00
40—<55	D	1,00
<40	E	0,00

Rubric(s)

A. Individual Assignment Score Criteria

Nilai	Kualitas Jawaban
>90	If students can complete more than 90% of the questions correctly
70-89	If students can complete more than 70% s.d. 89% of the questions correctly
60-69	If students can complete more than 60% s.d. 69% of the questions correctly
55-59	If students can complete more than 55% s.d. 59% of the questions correctly
50-54	If students can complete more than 50% s.d. 54% of the questions correctly

B. Mid term exam and Final term exam

1) Able to express ideas in solving problems (25%)
2) Be able to determine the right basic concepts in solving problems (35%)
3) Be able to formulate the final solution of problems correcting language errors (30%)
4) Able to use appropriate important units and figures (10%)