	Universitas Negeri Surabaya Faculty of Postgraduate School, Master of Technology and Vocational Education Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Digital Signal Processing)	8310102007		T=2	P=0	ECTS=4.48	2	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Prof. Dr. I.G.P. Asto Buditjahjanto, S.T.,M.T.	.....	Dr. Ir. Achmad Imam Agung, M.Pd.

Learning model	**Project Based Learning**

Program Learning Outcomes (PLO)

PLO study program which is charged to the course

Program Objectives (PO)

PO - 1	Students master the basic theoretical concepts of signal and system engineering, Fourier analysis, sampling, –z transformation
PO - 2	Students master the principles and techniques for designing LTI, DFT, FFT system transformation analysis and implementation, as well as filter design

PLO-PO Matrix

P.O
PO-1
PO-2

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																
PO-2																

Short Course Description	Provide understanding and knowledge to students related to signal processing material in digital form. Learning material includes the process of changing signals from analog to digital, operations for using digital signals in a system.

References

Main :

1. JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION
2. John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Apllication, 3rd ed, 1996, USA: Prentice-Hall

Supporters:

1. Monson H. Hayes, Schaum's outline of theory and problems of digital signal, 1999, New York: McGraw-Hill

Supporting lecturer	Prof. Dr. I Gusti Putu Asto Buditjahjanto, S.T., M.T. Dr. Lilik Anifah, S.T., M.T.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

1	1. Students understand the definition of signals and systems 2. a. Understand the basics of digital Signal Processing 3. b. Knowing discrete time signals 4. c. Knowing Discrete Time Systems 5. d. Understanding convolution 6. e. Understand different equations	1. 1. Students can explain the basics of digital signal processing 2. 2. Students can explain discrete time signals	**Criteria:** 1. 1. Students can express their opinions well 2. 2. Students can simulate signals using Matlab **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation, group discussion and reflection 2 X 50		**Material:** Discussing the basics of digital processing. **Reference:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%
2	1. Students understand the definition of signals and systems 2. a. Understand the basics of digital Signal Processing 3. b. Knowing discrete time signals 4. c. Knowing Discrete Time Systems 5. d. Understanding convolution 6. e. Understand different equations	1. 1. Students can explain the basics of digital signal processing 2. 2. Students can explain discrete time signals 3. 3. Students can explain the convolution process 4. 4. Students can calculate different equations	**Criteria:** 1. 1. Students can express their opinions well 2. 2. Students can simulate signals using Matlab **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation, group discussion and reflection 2 X 50		**Material:** Discussing the basics of digital processing. **Reference:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%
3	1. Students are able to analyze Fourier Analysis 2. 1. Students are able to explain the Basics of Frequency Response Networks 3. 2. Students are able to explain the types and functions of filters 4. 3. Students are able to explain the Discrete Time Fourier Transform	1. a. Students are able to describe the response frequency 2. b. Students are able to Show Filters 3. c. Students are able to demonstrate the interconnection of systems 4. d. Students are able to describe the discrete time Fourier transform 5. e. Students are able to demonstrate applications: LSI and LCCD systems, convolution performance, solving difference equations, inverse systems	**Criteria:** Demonstrate and simulate signals with Matlab **Form of Assessment** : Participatory Activities	Presentation, group discussion and reflection 2 X 50		**Material:** Discuss discrete time Fourier analysis and its applications. **Bibliography:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%

4	1.Students are able to analyze Fourier Analysis 2.1. Students are able to explain the Basics of Frequency Response Networks 3.2. Students are able to explain the types and functions of filters 4.3. Students are able to explain the Discrete Time Fourier Transform	1.a. Students are able to describe the response frequency 2.b. Students are able to Show Filters 3.c. Students are able to demonstrate the interconnection of systems 4.d. Students are able to describe the discrete time Fourier transform 5.e. Students are able to demonstrate applications: LSI and LCCD systems, convolution performance, solving difference equations, inverse systems	**Criteria:** Demonstrate and simulate signals with Matlab **Form of Assessment** : Participatory Activities	Presentation, group discussion and reflection 2 X 50		**Material:** Discuss discrete time Fourier analysis and its applications. **Bibliography:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%
5	1.Students are able to analyze Fourier Analysis 2.1. Students are able to explain the Basics of Frequency Response Networks 3.2. Students are able to explain the types and functions of filters 4.3. Students are able to explain the Discrete Time Fourier Transform	1.a. Students are able to describe the response frequency 2.b. Students are able to Show Filters 3.c. Students are able to demonstrate the interconnection of systems 4.d. Students are able to describe the discrete time Fourier transform 5.e. Students are able to demonstrate applications: LSI and LCCD systems, convolution performance, solving difference equations, inverse systems	**Criteria:** Demonstrate and simulate signals with Matlab **Form of Assessment** : Participatory Activities	Presentation, group discussion and reflection 2 X 50		**Material:** Discuss discrete time Fourier analysis and its applications. **Bibliography:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%
6	Students Analyze Z-Transformations	1.a. Students are able to explain the meaning of z-transformation 2.b. Students are able to describe the z-transformation properties 3.c. Students are able to explain the inverse Z-transformation 4.d. Students are able to describe one-sided z-transformations	**Criteria:** Students are able to demonstrate and simulate the z-transformation process **Form of Assessment** : Project Results Assessment / Product Assessment	Discussions, assignments, exercises, searching for library sources and other references 2 X 50		**Material:** Discuss and practice Z-transformation **Bibliography:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION* **Material:** Discuss and practice the Z-transformation **Bibliography:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall*	5%

7	Students Analyze Z-Transformations	1.a. Students are able to explain the meaning of z-transformation 2.b. Students are able to describe the z-transformation properties 3.c. Students are able to explain the inverse Z-transformation 4.d. Students are able to describe one-sided z-transformations	**Criteria:** Students are able to demonstrate and simulate the z-transformation process **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussions, assignments, exercises, searching for library sources and other references 2 X 50		**Material:** Discuss and practice Z-transformation **Bibliography:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION* **Material:** Discuss and practice the Z-transformation **Bibliography:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall*	5%
8	UTS	Students are able to demonstrate and simulate UTS questions	**Criteria:** Students are able to work on UTS questions **Form of Assessment** : Project Results Assessment / Product Assessment	Answer the questions on the 2 X 50 problem		**Material:** Making a program for UTS questions **Reader:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%
9		1.a. Students are able to function a system: Stable & Causal, Inverse System, Unit Sample Response for rational functions, frequency response for rational functions. 2.b. Students are able to explain the frequency response of the Allpass filter 3.c. Students are able to explain the minimum phase system 4.d. Students are able to describe one-sided z-transformations	**Criteria:** Students demonstrated well the results of the LTI System Transformation Analysis simulation **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, exercises and assignments 2 X 50		**Material:** Discuss the function of a system and practice frequency response. **Reference:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	0%

10		1.a. Students are able to function a system: Stable & Causal, Inverse System, Unit Sample Response for rational functions, frequency response for rational functions. 2.b. Students are able to explain the frequency response of the Allpass filter 3.c. Students are able to explain the minimum phase system 4.d. Students are able to describe one-sided z-transformations	**Criteria:** Students demonstrated well the results of the LTI System Transformation Analysis simulation **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, exercises and assignments 2 X 50		**Material:** Discuss the function of a system and practice frequency response. **Reference:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	25%
11	Students are able to describe DFT	1.a. Students are able to explain the Discrete Fourier Series 2.b. Students are able to analyze Discrete Fourier Transformations 3.c. Students are able to explain the properties of DFT 4.d. Students are able to understand DTFT sampling 5.e. Students are able to explain linear convolution using DFT	**Criteria:** Students are able to demonstrate and simulate the Discrete Fourier Transformation process **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, exercises and assignments 2 X 50		**Material:** Discuss and practice discrete Fourier transforms **References:** *Monson H. Hayes, Schaum's outline of theory and problems of digital signals, 1999, New York: McGraw-Hill*	5%
12	Students are able to understand FFT	1.a. Students are able to explain the Radix-2 FFT algorithm 2.b. Students are able to understand the FFT algorithm for N composites 3.c. Students are able to explain the FFT Prime Factors	**Criteria:** Students are able to demonstrate and simulate the FFT process **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, exercises and assignments 2 X 50		**Material:** Discuss and practice Fast Fourier Transform **Library:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%
13	Students are able to explain the implementation of discrete time	1.a. Students are able to explain digital networks 2.b. Students are able to describe the structure of the FIR system 3.c. Students are able to describe the structure of the IIR system 4.d. Students are able to explain the Lattice Filter	**Criteria:** Students are able to demonstrate and simulate the FIR and IIR System processes **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, assignments and exercises 2 X 50		**Material:** Discuss and practice discrete time implementation. **Reference:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%

14	Students are able to explain the implementation of discrete time	1.a. Students are able to explain digital networks 2.b. Students are able to describe the structure of the FIR system 3.c. Students are able to describe the structure of the IIR system 4.d. Students are able to explain the Lattice Filter	**Criteria:** Students are able to demonstrate and simulate the FIR and IIR System processes **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, assignments and exercises 2 X 50		**Material:** Discuss and practice discrete time implementation. **Reference:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%
15	1. 2.Students are able to Design Filters	1.a. Students are able to explain filter specifications 2.b. Students are able to design FIR filters 3.c. Students are able to Design IIR Filters 4.d. Students are able to design filters based on the least squares approach	**Criteria:** Students are able to demonstrate and simulate several types of filters **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, assignments and exercises 2 X 50		**Material:** Discuss and practice about filters **Reader:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	5%
16	UAS	Students are able to work on UAS questions	**Criteria:** Students showed well the results of the UAS simulation questions **Form of Assessment** : Project Results Assessment / Product Assessment	Answering and demonstrating UAS questions		**Material:** Carrying out UAS **Reader:** *JOHN W. LEIS. 2011. DIGITAL SIGNAL PROCESSING USING MATLAB FOR STUDENTS AND RESEARCHERS. A JOHN WILEY & SONS, INC., PUBLICATION*	10%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	35%
2.	Project Results Assessment / Product Assessment	65%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.