	Universitas Negeri Surabaya Faculty of Engineering, Electrical Engineering Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Digital Signal Processing	2020103116	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	4	August 1, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Case Studies**

Program Learning Outcomes (PLO)

PLO study program that is charged to the course	
PLO-6	Able to design system components and/or processes to be applied in the field of electrical engineering
PLO-8	Able to apply engineering principles, identify, formulate and analyze data/information to solve problems in the electrical field
Program Objectives (PO)	
PO - 1	Able to work in a team in solving Digital Signal Processing problems
PO - 2	Able to communicate effectively both orally and in writing in presenting digital signal processing results
PO - 3	Able to apply engineering principles, identify, formulate and analyze digital signal processing data/information to solve problems in the fields of electrical power systems, electronics, regulatory systems, telecommunications and intelligent computing
PO - 4	Able to plan, complete and evaluate tasks related to digital signal processing
PO - 5	Able to apply knowledge of mathematics and electrical engineering to gain a thorough understanding of the principles of digital signal processing

PLO-PO Matrix

P.O	PLO-6	PLO-8
PO-1		
PO-2		
PO-3		
PO-4		
PO-5		

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																
PO-3																
PO-4																
PO-5																

Short Course Description

This course provides learning experiences for students to be able to process a signal and process digital signals with applications in the fields of information, communication and control, explaining the introduction of digital signals, exploring discrete time invariant linear systems, determining Z-transformations, designing analog signal filtering, digital signal filtering: Infinite Impulse Response (IIR), digital signal filtering: Finite Impulse Response (FIR), describes the concept of Fourier transform for discrete signals, fast Fourier transform for discrete signals. Perform Matlab programming for signal processing and digital signal processing. The lecture is carried out in the form of a case method.

References

Main :

1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications. McGraw-Hill College., 2001

Supporters:

	1. Monson H. Hayes, Schaum's outline of theory and problems of digital signal, 1999, New York: McGrawHill 2. Oppenheim, V. Allan, and R.W. Schafer, Discrete Time Signal Processing. Prentice-Hall, New Jersey, USA.,1994 3. Ludeman, and Lonnie, Fundamentals of Digital Signal Processing. Prentice Hall., 2005
Supporting lecturer	Dr. Raden Roro Hapsari Peni Agustin Tjahyaningtijas, S.Si., M.T. Dr. Lusia Rakhmawati, 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	Students can analyze Signals and Discrete Time Systems Part 1	1. Able to explain the basics of digital signal processing 2. Able to identify discrete time Signals 3. Able to identify Discrete Time Systems	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 x 50		**Material:** 1. Introduction 2. Discrete Time Signals 3. Discrete Time Systems **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
2	Students can analyze Signals and Discrete Time Systems Part 2	1. Be able to explain convolution 2. Able to explain different equations	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Practice/Performance	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 x 50		**Material:** 1. Introduction 2. Discrete Time Signals 3. Discrete Time Systems **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%

3	Students can analyze the Discrete Time Fourier Transform Part 1	1. Able to describe the response frequency 2. Able to describe Filters 3. Able to show system interconnection	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 x 50		**Material:** Response Frequency **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.* **Material:** **Library** Filter : *Alan Oppenheim, Alan S. Willsky,* **Material:** System Interconnection **Library:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
4	Students can analyze the Discrete Time Fourier Transform Part 2	1. Able to analyze Discrete Time Fourier Transform 2. Able to identify DTFT Properties 3. Able to explain applications: LSI and LCCD systems, convolution performance, solving difference equations, inverse systems.	**Criteria:** 1. Activeness(quantity of participating) 2. Organization of ideas/arguments and accuracy of arguments 3. Use of Language 4. Evaluation Rubric **Form of Assessment** : Participatory Activities	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 x 50		**Material:** Discrete Time Fourier Transform, DTFT Properties and applications **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
5	Students can analyze Sampling Theory	1. Able to explain Analog to Digital Conversion 2. Able to explain Digital to Analog Conversion 3. Able to identify Discrete Time Analog Signal Processing 4. able to analyze sampling time conversion	**Criteria:** 1. Activeness(quantity of participating) 2. Organization of ideas/arguments and accuracy of arguments 3. Use of Language 4. Evaluation Rubric **Form of Assessment** : Participatory Activities	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 x 50		**Material:** 1. Analog to Digital Conversion; 2. Digital to Analog Conversion;3. Discrete Time Analog Signal Processing; 4. Sampling time conversion **Bibliography:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%

6	Students can analyze Transformation - Z Part 1	1. Able to explain the meaning of Transformation - z 2. Be able to describe the properties of the -z transformation	**Criteria:** 1. Activeness(quantity of participating) 2. Organization of ideas/arguments and accuracy of arguments 3. Use of Language 4. Evaluation Rubric **Form of Assessment** : Participatory Activities, Practice/Performance	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 x 50		**Material:** 1. Understanding Transformation - z 2. Properties of Transformation - z **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
7	Students can analyze Transformation - Z Part 2	1. Be able to explain the inverse transformation - z 2. Able to describe one-sided -z Transformation	**Criteria:** 1. Activeness(quantity of participating) 2. Organization of ideas/arguments and accuracy of arguments 3. Use of Language 4. Evaluation Rubric **Form of Assessment** : Participatory Activities	Case Study Method (Case Study Method) 3 x 50		**Material:** 3. Inverse Transformation - Z 4. One-sided -z Transformation **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
8	Complete the Midterm Exam	Able to explain, identify, analyze meeting material 1-7	**Criteria:** UTS is carried out with an assessment during the middle of the semester **Form of Assessment** : Test	Written Test 3 X 50		**Material:** Meeting material 1-7 **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	15%
9	Students can implement the steps of an FIR filter	1. students understand the relationship between discrete time systems and the concept of constructing an FIR filter 2. Students can implement the FIR filter according to the steps shown in the example.	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Case Study Method (Case Study Method) 3 X 50		**Material:** Meeting material 9 **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
10	Students know the steps in implementing an FIR filter	1. students understand the relationship between discrete time systems and the concept of constructing an FIR filter 2. Students can implement the FIR filter according to the steps shown in the example.	**Criteria:** Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10 **Form of Assessment** : Participatory Activities	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 X 50		**Material:** Meeting material 10 **Bibliography:** *Alan Oppenheim, Alan S. Willsky,* **Material:** Meeting material 10 **Reader:** *Gordon E. Carlson,*	5%

11	Students are able to provide a graphic description of the frequency response of an FIR	1. Students understand the frequency response to various forms of input signals 2. Students can provide a graphic description of the frequency response of an FIR 3. students are able to carry out transformations from the n-domain to the z-domain		Case Study Method (Case Study Method) 3 X 50		**Material:** meeting material 11 **Bibliography:** *Alan Oppenheim, Alan S. Willsky,*	5%
12	Students are able to provide a graphic description of the frequency response of an FIR	1. Students understand the frequency response to various forms of input signals 2. Students can provide a graphic description of the frequency response of an FIR 3. students are able to carry out transformations from the n-domain to the z-domain	**Form of Assessment** : Participatory Activities	Case Study Method (Case Study Method) 3 X 50		**Material:** Meeting material 12 **Bibliography:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
13	Students are able to construct an IIR filter transfer function	1. students understand the need for windowing in signal spectrum processing 2. students understand the concept of IIR filters 3. students can construct an IIR filter transfer function	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Demonstration Method (Demonstration Method) 3 X 50		**Material:** meeting material 13 **Bibliography:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
14	Students are able to construct an IIR filter transfer function	students can construct an IIR filter transfer function	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 X 50		**Material:** meeting material 14 **Bibliography:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%

15	Students are able to construct an IIR filter transfer function	1. students understand the need for windowing in signal spectrum processing 2. students understand the concept of IIR filters 3. students can construct an IIR filter transfer function	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lecture Method; Discussion Method (Discussion Method); Question and Answer Method (Question and Answer Method). 3 X 50		**Material:** meeting material 15 **Bibliography:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	5%
16	Complete the Final Semester Exam	All materials until the end of the semester	**Criteria:** Complete the Final Semester Exam **Form of Assessment** : Test	Written Test 3 x 50		**Material:** Meeting material 1-15 **References:** *John G Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 3rd ed, 1996, USA: Prentice-Hall.*	20%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	55%
2.	Project Results Assessment / Product Assessment	5%
3.	Practice / Performance	5%
4.	Test	35%
		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.