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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Antenna and Wave Propagation Practical	8320101248		T=0	P=1	ECTS=1.59	4	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. Nur Kholis, S.T., M.T.

Learning model	**Project Based Learning**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

	P.O

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

Short Course Description	This course explains the concepts and definitions of antennas and propagation, starting from understanding the basic concepts of antenna engineering, antenna performance parameters, dipole antennas, wire antennas, antenna loops, effective area theory, array antennas, radio wave propagation, broadband antennas, antenna aperture. , Microstrip antenna, smart antenna, Antenna measurements and antenna design simulation
References	**Main :**

1. John D. Kraus. 2001. Antenna for all application . McGraw-Hill Education Singapore
2. Fawwaz T Ulaby. 2015. Fundamentals of applied electromagnetics. Pearson Education Dorling Kindersley
3. Constantine A. Balanis,. 2005 . Antenna Theory Analysis and Design . John WilleY

	Supporters:
Supporting lecturer	Dr. Nurhayati, 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	Understand the basics of propagation and antenna techniques which include the basics of antenna radiation, short dipole radiation, far field approach. Power density	1.1. Explain the basic concept of antenna radiation 2.2. Explain the concept of Short Dipole / Hertzian Radiation 3.3. Explain the concept of the Far Field Approach 4.4. Explain the concept of Radiation Power Density	**Criteria:** Participation is seen from students' activeness in answering questions and discussing expressing opinions **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50			5%
2	Understand the basics of propagation and antenna techniques which include the basics of antenna radiation, short dipole radiation, far field approach. Power density	1.1. Explain the basic concept of antenna radiation 2.2. Explain the concept of Short Dipole / Hertzian Radiation 3.3. Explain the concept of the Far Field Approach 4.4. Explain the concept of Radiation Power Density	**Criteria:** 1.Participation is seen from students' activeness in answering questions and discussing expressing opinions 2.Assignments: Students carry out assignments given according to the indicators **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment	Lectures, discussions and questions and answers 4 X 50			5%
3	Understand the basics of propagation and antenna techniques which include the basics of antenna radiation, short dipole radiation, far field approach. Power density	1. Microstrip antenna design and simulation	**Criteria:** 1.Participation is seen from students' activeness in answering questions and discussing expressing opinions 2.Assignments: Students carry out assignments given according to the indicators **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50			10%
4	1. Show the results of the antenna simulation design	1. 2.1. Explain the concept of Antenna Radiation Characteristics 3.2. Explain the concept of Radiation Patterns 4.3. Explain the concept of antenna directivity 5.4. Explain the concept of Antenna Gain	**Criteria:** Participation is seen from students' activeness in answering questions and discussing expressing opinions **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment, Practical / Performance	Project work, discussions, questions and answers 2 X 50			10%

5	Understand the characteristics of antenna radiation which include antenna radiation pattern, beam dimensions, antenna directivity, gain, radiation resistance	1. Explain the concept of Antenna Radiation Characteristics 2. Explain the concept of Radiation Pattern 3. Explain the concept of Antenna Directivity 4. Explain the concept of Antenna Gain 5. Explain the concept of Radiation Resistance		Lectures, discussions, questions and answers 2 X 50			0%
6	Understanding dipole antennas, dipole antenna directivity, dipole antenna radiation resistance, multiple dipole antennas	1. Explain the concept of dipole antenna 2. Explain the concept of dipole antenna directivity 3. Explain the concept of dipole antenna radiation 4. Explain the concept of multiple dipole antenna		discussion, lecture and question and answer 2 X 50			0%
7	Understanding dipole antennas, dipole antenna directivity, dipole antenna radiation resistance, multiple dipole antennas	1. Explain the concept of dipole antenna 2. Explain the concept of dipole antenna directivity 3. Explain the concept of dipole antenna radiation 4. Explain the concept of multiple dipole antenna		discussion, lecture and question and answer 2 X 50			0%
8	UTS			2 X 50			0%
9	Understanding Maximum Antenna Power Transfer, Friss Transmission Formula, Gap Antenna Theory			ppt and questions and answers 2 X 50			0%
10	Linear, planar and circular array antenna theory Students are able to simulate the total array pattern by multiplying the pattern elements and array factors Array antenna applications Describe several scientific articles on the topic of array antennas	1. Students are able to describe linear, planar and circular antenna arrays 2. Students are able to simulate total array patterns by multiplying pattern elements and array factors 3. Students can show the application of array antennas 4. Students can describe several scientific articles on the topic of array antennas	**Criteria:** Accuracy in completing tasks, able to simulate array antennas with the Matlab program.	Group assignments, discussions and presentations 2 X 50			0%
11	Students are able to describe Radio wave propagation Students are able to simulate the performance of a MIMO antenna from transmitter to receiver Review papers on the theme of MIMO antenna communication and channel propagation	1. Students are able to describe the types of radio wave propagation 2. Students are able to simulate the performance of a MIMO antenna from transmitter to receiver 3. Reviewing papers with the theme MIMO antenna communications and channel propagation	**Criteria:** Activeness and accuracy in completing tasks	Group discussion and 2 X 50 simulation			0%

12	Students explain Broadband antenna, antenna aperture	1. Students explain that broadband antennas include tapered slot antennas 2. Students are able to show the types of antenna apertures: rectangular aperture, circular aperture 3. Students are able to describe a horn antenna 4. Students know broadband antenna applications	**Criteria:** The activeness and depth of the material presented	Group presentation 2 X 50			0%
13	Students are able to show the types of microstrip antennas. Students are able to describe microstrip antenna applications. Students are able to describe smart antennas	1. Students understand the types of microstrip antennas 2. Students are able to show the application of a microstrip antenna 3. Students are able to describe a smart antenna	**Criteria:** Depth of delivery of material, understanding of the material presented and activeness	Presentation assignments for each group 2 X 50			0%
14	Can design microstrip antennas using electromagnetic computing software (CST/HFFS) Analyzing antenna performance from simulation results Fabrication of design results Measurement and analysis of results	1. Students are able to design microstrip antennas using electromagnetic computing software (CST/HFFS) 2. Students can interpret and analyze antenna performance from the results of the simulations carried out 3. Students can fabricate design results 4. Measurement and analysis of results 5. Students make reports on antenna performance results	**Criteria:** Results of antenna design, fabrication and report results from simulation and fabrication results	Group assignments in antenna design, fabrication and writing reports on simulation and fabrication results 2 X 50			0%

15	Can design microstrip antennas using electromagnetic computing software (CST/HFFS) Analyzing antenna performance from simulation results Fabrication of design results Measurement and analysis of results	1. Students are able to design microstrip antennas using electromagnetic computing software (CST/HFFS) 2. Students can interpret and analyze antenna performance from the results of the simulations carried out 3. Students can fabricate design results 4. Measurement and analysis of results 5. Students make reports on antenna performance results	**Criteria:** Results of antenna design, fabrication and report results from simulation and fabrication results	Group assignments in antenna design, fabrication and writing reports on simulation and fabrication results 2 X 50			0%
16	UAS			2 X 50			0%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	19.17%
2.	Project Results Assessment / Product Assessment	4.17%
3.	Practical Assessment	4.17%
4.	Practice / Performance	2.5%
		30.01%

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.