	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
Antennas and Propagation	2020102335	Compulsory Study Program Subjects	T=0	P=0	ECTS=0	5	April 10, 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

Program Objectives (PO)

PO - 1	Shows a general overview of antennas, radiation mechanisms and current distribution.
PO - 2	Able to design and carry out experiments in the laboratory/field as well as analyze and interpret data to strengthen the assessment of antenna and propagation materials
PO - 3	Able to apply engineering principles, identify, formulate and analyze data/information to solve problems in the field of antennas and propagation
PO - 4	Able to plan, complete and evaluate antenna and propagation tasks related to the field of electrical engineering.
PO - 5	Able to be responsible to society by complying with religious norms, professional ethics and being responsible for resolving antenna and propagation problems
PO - 6	Students have the responsibility to explain the antenna design and antenna applications created.

PLO-PO Matrix

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

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																
PO-6																

Short Course Description	This course examines and provides an understanding of the general description of antennas and wave propagation, radiation mechanisms and current distribution, types of antennas and their applications, antenna performance in the form of: Radiation Patterns, Power Density and Radiation Intensity and Efficiency, Beamwidth and Directivity, Numerical Techniques , Gain, Beam efficiency, Bandwidth, Polarization, Input Impedance, potential sources of current and electric and magnetic fields, Wave equation, Far field radiation, Dipole antenna, grounding effect, Circular loop, Polygonal loop antenna, designing Broadband Dipole Antenna, Biconical Antenna, Triangular, Bow Tie, Cylinder, Folded Dipole, Spiral Antenna, log periodic, Fraactal antenna, Horn Antenna and Microstrip Antenna, Planar and Circular Array, 3-dimensional design and characteristics for N element array, MIMO antenna, smart antenna, antenna simulation and measurement .
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 4. B. Gross. 2011. Frontiers in Antennas Next Generation Design & Engineering . Mc Graw Hill 5. G. Ray, K.Kumar.2003. Broadband Microstrip Antennas . British.ARTECH HOUSE, INC 6. R.L.Haupt.2010. Antenna Arrays : A Computational Approach . John Wiley & Sons, Inc
	Supporters:
	1. R.L.Haupt, Antenna Arrays : A Computational Approach. John Wiley & Sons, Inc, 2010.G. Ray, 2. K.Kumar, Broadband Microstrip Antennas. British: ARTECH HOUSE, INC, 2003.
Supporting lecturer	Dr. Nurhayati, S.T., M.T. Pradini Puspitaningayu, S.T., M.T., Ph.D.

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	Describe a general overview of an antenna	· Describe the basic concept of antennas · Explain the mechanisms of radiation and current distribution. Explain transmission channels	**Criteria:** 1.Assessment criteria by looking at: 2.Participation: student activity in expressing opinions, discussing (weight 2) 3.Task: carried out in each indicator (weight 3) **Form of Assessment** : Participatory Activities	Presentations, group discussions, 2 X 50 discussions		**Material:** Meeting material 1 **Reader:** *John D. Kraus. 2001. Antennas for all applications. McGraw-Hill Education Singapore*	3%
2	Shows describing the types of antennas and their applications	· Identify the types of antennas and their applications. · Describe the types of antennas and their applications.	**Criteria:** 1.The assessment criteria are seen from the aspects: 2.Participation: student activity in expressing opinions, answering problem solving, discussing (weight 2) 3.Task: carried out in each indicator (weight 3) **Form of Assessment** : Participatory Activities	Problem Based Learning (PrBL) Model 2 X 50		**Material:** Meeting material 2 **Reader:** *Fawwaz T Ulaby. 2015. Fundamentals of applied electromagnetics. Pearson Education Dorling Kindersley*	3%

3	Identifying antenna performance in the form of: Radiation Pattern, Power Density and Radiation Intensity and efficiency	Describes radiation patterns, power density and radiation intensity and efficiency	**Criteria:** 1. The assessment criteria are seen from: 2. Participation: student activity in expressing opinions, answering problem solving, discussing (weight 2) 3. Task: carried out in each indicator (weight 3) **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	· Direct and Cooperative Learning Model 2 X 50		**Material:** Meeting material 3 **Reader:** *Fawwaz T Ulaby. 2015. Fundamentals of applied electromagnetics. Pearson Education Dorling Kindersley*	3%
4	Describe Beamwidth and directivity, Numerical Techniques, Gain, Beam efficiency, Bandwidth, Polarization, Input Impedance, potential sources of current and electric and magnetic fields, Wave equations, Far field radiation, Dipole antennas, grounding effects, Circular loops, Polygonal loop antennas.	Describe Beamwidth and directivity, Numerical Techniques, Gain, Beam efficiency, Bandwidth, Polarization Determine Input Impedance, potential sources of current and electric and magnetic fields, Wave equations, Far field radiation, Describe the electronic circuit of analog modulators and demodulators. Explain dipole antenna, grounding effect, circular loop, polygonal loop antenna.	**Criteria:** 1. The assessment criteria are seen from the aspects: 2. Participation: student activity in expressing opinions, answering problem solving, discussing (weight 2) 3. Task: carried out in each indicator (weight 3) **Form of Assessment** : Participatory Activities	Task Based Cooperative Learning Model (Task Based Learning-TBL) 2 X 50		**Material:** Meeting material 4 **Reader:** *B. Gross. 2011. Frontiers in Next Generation Antennas Design & Engineering. McGraw Hill*	3%
5	Describe Beamwidth and directivity, Numerical Techniques, Gain, Beam efficiency, Bandwidth, Polarization, Input Impedance, potential sources of current and electric and magnetic fields, Wave equations, Far field radiation, Dipole antennas, grounding effects, Circular loops, Polygonal loop antennas.	Describe Beamwidth and directivity, Numerical Techniques, Gain, Beam efficiency, Bandwidth, Polarization Determine Input Impedance, potential sources of current and electric and magnetic fields, Wave equations, Far field radiation, Describe the electronic circuit of analog modulators and demodulators. Explain dipole antenna, grounding effect, circular loop, polygonal loop antenna.	**Criteria:** 1. Assessment criteria by looking at: 2. Participation: student activity in expressing opinions, answering problem solving, discussing (weight 2) 3. Task: carried out in each indicator (weight 3)	Task Based Cooperative Learning Model (Task Based Learning-TBL) 2 X 50		**Material:** Meeting material 5 **References:** *G. Ray, K.Kumar.2003. Broadband Microstrip Antennas. British. ARTECH HOUSE, INC*	3%

6	Describe Linear, Planar and Circular Array, N element array, MIMO antenna, smart antenna and Broadband Dipole Antenna, Biconical Antenna, Triangular	Describes Linear, Planar and Circular Array, N element array, MIMO antenna, smart antenna Shows Broadband Dipole Antenna, Biconical Antenna, Triangular	**Criteria:** 1. Assessment criteria by looking at: 2. Participation: student activity in delivering presentations, answering problem solving, discussing (weight 2) 3. Task: carried out in each indicator (weight 3)	Project Based Larning 2 X 50		**Material:** Meeting material 6 **References:** *K.Kumar, Broadband Microstrip Antennas. British: ARTECH HOUSE, INC., 2003.*	5%
7	Describe Linear, Planar and Circular Array, N element array, MIMO antenna, smart antenna and Broadband Dipole Antenna, Biconical Antenna, Triangular	Describes Linear, Planar and Circular Array, N element array, MIMO antenna, smart antenna Shows Broadband Dipole Antenna, Biconical Antenna, Triangular	**Criteria:** 1. The assessment criteria are seen from: 2. 1. Participation: student activity in delivering presentations, answering problem solving, discussing (weight 5) 3. 2. Task: carried out for each indicator (weight 5) **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Project Based Larning 2 X 50		**Material:** Meeting material 7 **References:** *RLHaupt, Antenna Arrays : A Computational Approach. John Wiley & Sons, Inc, 2010.G. Ray,*	5%
8	UTS	1. Understand the concept of antennas and wave propagation 2. Understand the types of antennas	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment, Test	Test/Quiz 2 X 50		**Material:** Meeting material 1-7 **Reader:** *John D. Kraus. 2001. Antennas for all applications. McGraw-Hill Education Singapore*	20%
9	Shows Bow Tie, Cylinder, Folded Dipole	· Explain Bow Tie, Cylinder, Folded Dipole	**Criteria:** 1. Evaluation Rubric (weight 2) 2. Task: carried out in each indicator (weight 3) **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation, group discussion and reflection 2 X 50		**Material:** Meeting material 9 **Reader:** *John D. Kraus. 2001. Antennas for all applications. McGraw-Hill Education Singapore*	3%
10	Shows software supporting antenna design	Shows software supporting antenna design	**Criteria:** 1. Evaluation Rubric(5) 2. Participation: student activity in showing design results, answering problem solutions, discussing (weight 5) **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion and reflection 2 X 50		**Material:** Meeting material 10 **Reader:** *Fawwaz T Ulaby. 2015. Fundamentals of applied electromagnetics. Pearson Education Dorling Kindersley*	3%

11	Antenna simulation along with applications and measurements and Design and performance analysis of Broadband Dipole Antenna, Biconical Antenna, Planar Antenna	· Antenna simulation along with applications and measurements Design and performance analysis of Broadband Dipole Antenna, Biconical Antenna, Planar Antenna	**Criteria:** Task: carried out in each indicator (weight 5) **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Group discussion, Project Based Learning, reflection 2 X 50		**Material:** Meeting material 11 **Reader:** *John D. Kraus. 2001. Antennas for all applications. McGraw-Hill Education Singapore*	5%
12	Antenna simulation along with applications and measurements and Design and performance analysis of Broadband Dipole Antenna, Biconical Antenna, Planar Antenna	· Antenna simulation along with applications and measurements Design and performance analysis of Broadband Dipole Antenna, Biconical Antenna, Planar Antenna	**Criteria:** 1.Evaluation Rubric 2.Participation is seen from students' activeness in answering questions and discussing expressing opinions (weight 5) 3.Task: carried out in each indicator (weight 3) **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment	DiscussionPBL 2 X 50		**Material:** Meeting material 12 **Reader:** *Constantine A. Balanis. 2005 . Antenna Theory Analysis and Design. John WilleY*	3%
13	Design and performance analysis of microstrip, Triangular, Bow Tie, Cylinder, Folded Dipole antennas	Able to design and analyze the performance of microstrip, Triangular, Bow Tie, Cylinder, Folded Dipole antennas	**Criteria:** 1.Evaluation Rubric 2.Assignments: Students carry out assignments given according to the indicators **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment	presentation, group discussion and reflection 2 X 50		**Material:** Meeting material 13 **Reader:** *John D. Kraus. 2001. Antennas for all applications. McGraw-Hill Education Singapore* **Material:** Meeting material 13 **References:**	3%
14	Design and performance analysis of Spiral Antenna.log periodic, Fraactal antenna, Design and performance analysis of Antenna array, MIMO	Design and performance analysis of Spiral Antenna.log periodic, Fraactal antenna Design and performance analysis of Antenna array, MIMO	**Criteria:** Participation: student activity in showing design results, answering problem solutions, discussing (weight 5) **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	PBL 2 X 50 Discussion		**Material:** Meeting material 14 **References:** *G. Ray, K.Kumar.2003. Broadband Microstrip Antennas. British. ARTECH HOUSE, INC*	5%
15	Design and performance analysis of Spiral Antenna.log periodic, Fraactal antenna, Design and performance analysis of Antenna array, MIMO	Design and performance analysis of Spiral Antenna.log periodic, Fraactal antenna Design and performance analysis of Antenna array, MIMO	**Criteria:** Evaluation Rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	PBL 2 X 50 Discussion		**Material:** Meeting material 15 **Reader:** *John D. Kraus. 2001. Antennas for all applications. McGraw-Hill Education Singapore*	5%
16	UAS	Can understand and carry out antenna design and analysis of results	**Criteria:** Evaluation Rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practice / Performance, Tests	UAS 2 X 50		**Material:** Meeting materials 1-15 **Reader:** *John D. Kraus. 2001. Antennas for all applications. McGraw-Hill Education Singapore*	30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	31.34%
2.	Project Results Assessment / Product Assessment	32.34%
3.	Portfolio Assessment	1.67%
4.	Practical Assessment	2%
5.	Practice / Performance	9.17%
6.	Test	17.5%
		94.02%

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.