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

SEMESTER LEARNING PLAN

Courses		CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Radar and Navigation		8320102146		T=2	P=0	ECTS=3.18	5	July 18, 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	Students understand and are able to show the history and spectrum of radar, radar block diagrams, radar equations, types of radar, CW/FW radar, doppler pulse, tracking radar, radar antenna, moving target identity, monopulse radar, phased array radar, digital beam forming, radar signal and noise detection, clutter, and other radar topics

References	**Main :**
	1. Dr. R.P Cantherford. Training Material on Weather Radar System 2. M.l. Skolnik. 2000. Introduction to Radar System . McGraw-Hill Book Company, Third edition 3. B. A. Mahafza. 2000. Radar Systems Analysis and Design Using Matlab . Chapman & Hall/CRC, 2000 4. Michael Kolowole. 2002 . Radar Ssytem Peak Detecetion and Tracking . Newness 5. Peter Devine. 2000. Radar level measurement . VEGA Controls LtdPeter Devine,
	Supporters:
Supporting lecturer	Dr. Raden Roro Hapsari Peni Agustin Tjahyaningtijas, S.Si., M.T. Dr. Lusia Rakhmawati, S.T., M.T. Miftahur Rohman, 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	Understanding the History and Electromagnetic Spectrum of radar	1. Explains the application and history of radar. 2. Interpreting frequency, wavelength, speed of electromagnetic waves 3. Shows the band or spectrum of radar electromagnetic waves	**Criteria:** 1.1. Activity 2.2. Answer the questions correctly	Lectures, discussions and questions and answers 2 X 50			0%
2	1. Understand the history of radar 2. Understand the meaning of radar 3. Understand the doopler effect	Students can understand and solve problems related to Understanding the working principles of Radar, Understanding the Doppler effect, Applying the principles of the Doppler effect	**Criteria:** 1.1. Full marks are obtained if you do all the questions correctly 2.2. Data completeness	Lectures, discussions and questions and answers 2 X 50			0%
3	Understand the working principles and infrastructure of radar, know the radar equation to determine distance, elevation, azimuth, speed and radar signal parameters, as well as applications in aviation navigation	1. Students can explain the working principles and infrastructure of radar 2. Students can show the equation of a radar signal to obtain distance, elevation, azimuth, speed and other parameters of a radar signal 3. Know the working principles of radar and aviation navigation	**Criteria:** Activeness and accuracy of answers	discussion, lecture and question and answer 2 X 50			0%
4	1. Understand the elements in the radar infrastructure 2. Understand the elements of radar security 3. Explain and understand radar maintenance 4. Explain and understand radar maintenance	1. Students can understand tower elements and voltage generators. 2. Students can understand radar protection elements. 3. Students can understand communications and networks. 4 Types and Maintenance Process 5 Equipment used in Maintenance 6 Measurements on transmitters and receivers		discussion, lecture and question and answer 2 X 50			0%
5	Understand the working principles and infrastructure of radar, know the radar equation to determine distance, elevation, azimuth, speed and radar signal parameters	1. Students can understand the working principles and infrastructure of radar 2. Students can show the equation of a radar signal to obtain distance, elevation, azimuth, speed and other parameters of a radar signal.	**Criteria:** liveliness and correctness of answering questions	discussion, lecture and question and answer 2 X 50			0%

6	Shows Radar Types and working principles of primary radar and secondary radar	1. Continuous Wave Radar (CW) 2. Relationship between Frequency, Wavelength and Sound Heard 3. FM-CW (Frequency Modulated Continuous Wave Radar) 4. Pulse Radar 5. Primary radar and secondary radar		Lectures, discussions, exercises 2 X 50				0%
7	Able to show searching radar, tracking radar and imaging radar, can describe the types of antennas and their applications	1. Able to show searching radar, tracking radar and imaging radar 2. Can describe the types of antennas and their applications	**Criteria:** The activeness and depth of the material presented	Group assignments and presentations 2 X 50				0%
8	UTS			2 X 50				0%
9	Demonstrates the theory of Moving Target Identity (MTI), Monopulse Radar	1. Can explain the Moving Target Indicator 2. Shows Pulse Doppler Radar 3. Describe radar signal processing	**Criteria:** Activeness and ability to understand the tasks given	Group assignments and simulations with Matlab 2 X 50				0%
10	Able to explain phase array radar and digital beam forming on radar	1. Understanding Phased array radar electronically 2. Demonstrates phased array radar applications 3. Describes a radar antenna based on phased array radar 4. Shows digital beam forming on the radar	**Criteria:** Activeness, accuracy in completing tasks, depth of understanding of the tasks presented	Group assignments, program simulations, 2 X 50 presentations				0%
11	Can show the process of detecting radar signals, noise in radar signals, threshold and clutter	1. Can show the process of detecting radar signals 2. Can describe the types of noise in radar signals 3. Can find out the target signal criteria, threshold and noise signals on the radar 4. Can show the types of clutter in radar signals	**Criteria:** Activeness and correctness of material delivery	Presentation and group discussion 2 X 50				0%
12	Shows another topic of radar applications, namely Synthetic Aperture Radar	1. Students can show other topics of radar applications 2. Explains an example of Synthetic Aperture Radar 3. Explain the principles of Synthetic Aperture Radar 4. Describing HF Over the Horizon Radar	**Criteria:** Activeness and accuracy in delivering material	Presentation and group discussion 2 X 50				0%

13	Describes the working principles and applications of Air-Surveillance Radar. Shows examples of 3D Radar and antennas	1.Can show the working principles and applications of Air-Surveillance Radar 2.Can explain examples of 3D Radar and antennas	**Criteria:** Presentation results and ability to explain material	Presentation and group discussion 2 X 50			0%
14	Understand the working principle of Bistatic Radar. Describe the application of Millimeter Wave Radar	Explain the working principle of Bistatic Radar. Describe the application of Millimeter Wave Radar	**Criteria:** Activeness and understanding of the material presented	Presentation and group discussion 2 X 50			0%
15	Reviewing research related to Radar	Can explain scientific articles related to radar	**Criteria:** Activeness in conveying and understanding the material	Group presentation 2 X 50			0%
16	UAS	UAS		UAS 2 X 50			0%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
		0%

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.