SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Radar and Navigation Systems	2010102024		**T=2**	**P=0**	**ECTS=4.48**	3	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	....	....	Unit Three Kartini, S.T., M.T., Ph.D.

Learning model	Case Studies

Program Learning Outcomes (PLO)	PLO study program that is charged to the course
	Program Objectives (PO)
	PO - 1 — Students are able to know the history of the concept of the radar electromagnetic spectrum
	PO - 2 — Students are able to analyze basic radar concepts and radar block diagrams
	PO - 3 — Students are able to describe the types of CW/FM radar, pulse Doppler and tracking radar
	PO - 4 — Students are able to describe the components of a radar system
	PO - 5 — Students are able to analyze how radar antennas and scanning, moving target identification, and phase array radar work
	PO - 6 — Students are able to analyze the effect of antenna shape on the radar system
	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	Students are able to explain the history of radar development, understand how radar concepts and block diagrams work, know the mathematical function equations of radar systems, and explain the types of CW/FM radar, pulse Doppler and radar tracking, analyze how components in a radar system work, provide types of antennas which can be used by radar systems, explaining how moving target identification (MTI), Monopulse Radar, Phase Array Radar, Digital Beamforming, SONAR, Satellite navigation, GPS, navigation with tracking works.

References	**Main :**

1. Radar Systems Analysis and Design Using MATLAB,.2000.Mahafza , Bassem R., CRC Press
2. David Jenn,"Radar Fundamentals",Department of Electrical & Computer Engineering
3. Merrill Ivan Skolnik - Introduction to Radar Systems-Mcgraw-Hill College (1980)
4. B. Mahafza - MATLAB simulations for radar systems design-CRC Press_Chapman & Hall (2004)

Supporters:	

1. Michael Kolowole, 2002, " Radar Ssytem Peak Detectetion and Tracking", Newness
2. Peter Devine,2000,"Radar level measurement", VEGA Controls Ltd

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	Understanding the History and Electromagnetic Spectrum of radar	1.Can explain the application and history of radar 2.Can interpret frequency, wavelength, speed of electromagnetic waves	**Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practice / Performance	Lectures, questions and answers, discussions			5%
2	Understanding the History and Electromagnetic Spectrum of radar	1.Can explain the application and history of radar 2.Can interpret frequency, wavelength, speed of electromagnetic waves	**Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practice / Performance	Lectures, questions and answers, discussions			5%
3	Understand the basic concepts of radar and radar block diagrams	1.Can describe the basic concepts of radar 2.Can Show radar block diagram	**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Lectures, discussions, questions and answers			5%
4	Understand the basic concepts of radar and radar block diagrams	1.Can describe the basic concepts of radar 2.Can Show radar block diagram	**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Lectures, discussions, questions and answers			5%
5	Interpreting Radar equations	1.Can Show the radar antenna transmission power (W) 2.Can show received power (W) 3.Can show the gain of the transmitting antenna and receiving antenna 4.Can Show radar cross section (RCS) 5.Can show the effective aperture area of receive antenna	**Criteria:** Activeness, accuracy in explaining the tasks given **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Lectures, questions and answers, projects,			5%

6	Interpreting Radar equations	1. Can Show the radar antenna transmission power (W) 2. Can show received power (W) 3. Can show the gain of the transmitting antenna and receiving antenna 4. Can Show radar cross section (RCS) 5. Can show the effective aperture area of receive antenna	**Criteria:** Activeness, accuracy in explaining the tasks given **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Lectures, questions and answers, projects,			5%
7	Classifying radar types	1. Can show the types of radar according to the form of the signal 2. Can show the types of radar according to their function	**Criteria:** Activeness, accuracy in explaining the tasks given **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Discussion, question and answer, doing assignments			5%
8	Classifying radar types	1. Can show the types of radar according to the form of the signal 2. Can show the types of radar according to their function	**Criteria:** Activeness, accuracy in explaining the tasks given **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Discussion, question and answer, doing assignments			5%
9	UTS			Working on questions, presentations			10%
10	Interpret radar system components	1. Can identify supporting components for radar devices 2. Can Describe Oscillators of radar systems 3. Can Show radar signal processing circuit 4. Can describe mixer circuits, radar system transmission channels 5. Can describe mixer circuits, radar system transmission channels.	**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Carrying out project assignments, discussions, questions and answers			5%

11	Describe radar and scanning antennas	1. Describe the types of antennas used by radar systems 2. Interpret antenna gain 3. Radiation angle Polarization	**Criteria:** Activeness, accuracy in explaining the tasks given **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment, Practical / Performance	Carrying out project assignments, discussions, questions and answers				5%
12	Describe radar and scanning antennas	1. Describe the types of antennas used by radar systems 2. Interpret antenna gain 3. Radiation angle Polarization	**Criteria:** Activeness, accuracy in explaining the tasks given **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment, Practical / Performance	Carrying out project assignments, discussions, questions and answers				5%
13	Interpret radar display methods	1. Can Show How to read radar displays for several applications 2. Can Show Moving Target Identification(MTI) radar, Monopulse Radar, Phase Array Radar, Digital Beamforming	**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Tests	discussions, doing assignments, presentations				10%
14	Interpret radar display methods	1. Can Show How to read radar displays for several applications 2. Can Show Moving Target Identification(MTI) radar, Monopulse Radar, Phase Array Radar, Digital Beamforming	**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Tests	discussions, doing assignments, presentations				10%
15	Describe conventional navigation, SONAR, satellite navigation, GPS, navigation with tracking and homing	Can show conventional navigation, SONAR, satellite navigation, GPS, navigation with tracking	**Criteria:** Activeness, accuracy in explaining the tasks given **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, discussions, presentations				14%
16	UAS		**Form of Assessment** : Participatory Activities					10%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	41.19%

2.	Project Results Assessment / Product Assessment	27.85%
3.	Portfolio Assessment	3.34%
4.	Practical Assessment	2.5%
5.	Practice / Performance	17.53%
6.	Test	6.66%
		99.07%

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.