| | Universitas Negeri Surabaya<br>Faculty of Engineering,<br>Electrical Engineering Undergraduate Study Program | Document Code |
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## SEMESTER LEARNING PLAN

| Courses | | CODE | Course Family | Credit Weight | | | SEMESTER | Compilation Date |
|---|---|---|---|---|---|---|---|---|
| Radar and Navigation | | 2020102341 | Compulsory Study Program Subjects | T=0 | P=0 | ECTS=0 | 5 | April 27, 2023 |

| AUTHORIZATION | SP Developer | Course Cluster Coordinator | Study Program Coordinator |
|---|---|---|---|
| | Hapsari Peni, Lusia Rakhmawati | Prof. Dr. IGP Asto Budi T | Dr. Lusia Rakhmawati, S.T., M.T. |

| Learning model | Case Studies |
|---|---|

| Program Learning Outcomes (PLO) | **PLO study program that is charged to the course** | |
|---|---|---|
| | **Program Objectives (PO)** | |
| | PO - 1 | Able to explain the basic working principles of Radar, Sonar and Navigation systems |
| | PO - 2 | Know the history, frequency, function/general use and range of Radar systems |
| | PO - 3 | Know the working principles, use and mathematical analysis of Pulse Radar, CW Radar, FM-CW Radar |
| | PO - 4 | Know the functions, working principles, types and mathematical analysis of MTI Radar |
| | PO - 5 | Know the meaning, functions, types and mathematical analysis of Tracking Radar |
| | PO - 6 | Know the main parts of the transmitter, receiver and types of Radar antennas |
| | **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 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 |
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| 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 Detectetion and Tracking . Newness
5. Peter Devine. 2000. Radar level measurement . VEGA Controls LtdPeter Devine,

| Supporters: | |
|---|---|

1. Merrill I. Skolnik. 2008. Radar Handbook, 3rd Edition. McGraw-Hill Education.

| Supporting lecturer | Dr. Raden Roro Hapsari Peni Agustin Tjahyaningtijas, S.Si., M.T.<br>Dr. Nurhayati, S.T., M.T.<br>Dr. Lusia Rakhmawati, S.T., M.T. |
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| 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<br><br>**Form of Assessment** : Participatory Activities | Lectures, discussions and questions and answers 2 X 50 | Lectures, discussions and questions and answers | **Material:** Meeting material 1 **Reader:** *Ml Skolnik. 2000. Introduction to Radar Systems. McGraw-Hill Book Company, Third edition* | 3% |
| 2 | Understanding the History of Radar, Understanding radar and the Doppler Effect | 1.Students can understand and solve problems related to 2.Understand the working principles of Radar 3.Understand the Doppler effect 4.Applying the principle of the Doppler effect | **Criteria:** 1.1. Full marks are obtained if you do all the questions correctly 2.2. Data completeness<br><br>**Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | Lectures, discussions and questions and answers 2 X 50 | | **Material:** Meeting material 2 **Reader:** *Dr. R.P. Cantherford. Training Material on Weather Radar System* | 3% |
| 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 | discussions, lectures and questions and answers | **Material:** Meeting material 3 **Reference:** *BA Mahafza. 2000. Radar Systems Analysis and Design Using Matlab. Chapman & Hall/CRC, 2000* | 3% |

| 4 | Understand the elements in radar infrastructure, radar security elements, radar maintenance and explain and understand radar maintenance | 1.1. Students can understand Tower Elements and voltage generators. 2.2. Students can understand the elements of radar protection 3.3. Students can understand Communication and Networking 4.4 Types and Maintenance Process 5.5 Equipment used in Maintenance 6.6 Measurements on the transmitter and receiver | **Form of Assessment** : Participatory Activities | discussion, lecture and question and answer 2 X 50 | discussions, lectures and questions and answers | **Material:** Meeting material 4 **Bibliography:** *Ml Skolnik. 2000. Introduction to Radar Systems. McGraw-Hill Book Company, Third edition* | 3% |
|---|---|---|---|---|---|---|---|
| 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 **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | - Method: Case Method Learning Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. | - Method: Case Method Learning Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide | **Material:** Meeting material 6 **Bibliography:** *Ml Skolnik. 2000. Introduction to Radar Systems. McGraw-Hill Book Company, Third edition* | 3% |

| | | | | Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to 2 X 50 questions | suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to questions | | |
|---|---|---|---|---|---|---|---|
| 6 | Shows Radar Types and working principles of primary radar and secondary radar | 1. 1. Continuous Wave Radar (CW) 4. Pulse Radar<br>2. 2. Relationship between Frequency, Wavelength and Sound Heard<br>3. 3. FM-CW (Frequency Modulated Continuous Wave Radar)<br>4. 5. Primary radar and secondary radar | **Form of Assessment**:<br>Project Results Assessment / Product Assessment | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases | **Material:** Meeting material 6 **Bibliography:** *Merrill I. Skolnik. 2008. Radar Handbook, 3rd Edition. McGraw-Hill Education.* | 5% |

| | | | | solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to 2 X 50 questions | presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to questions | | |
|---|---|---|---|---|---|---|---|
| **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 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment | Group assignments and presentations - Method: Case Method Learning Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying close attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and | - Method: Case Method Learning Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect | **Material:** Meeting material 7 **Bibliography:** *Ml Skolnik. 2000. Introduction to Radar Systems. McGraw-Hill Book Company, Third edition* | 5% |

| # | Topic | Indicators | Assessment | Learning Method | Learning Method | Reference | Weight |
|---|---|---|---|---|---|---|---|
| | | | | processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to 2 X 50 questions | and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to questions | | |
| 8 | UTS | | **Form of Assessment** : Project Results Assessment / Product Assessment, Test | Written Test 2 X 50 | | **Material:** Meeting material 1-7 **Reader:** *Michael Kolowole. 2002 . Radar System Peak Detection and Tracking. Newness* | 20% |
| 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 **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and | **Material:** Meeting material 9 **Reader:** *Michael Kolowole. 2002 . Radar System Peak Detection and Tracking. Newness* | 3% |

| | | | | process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to 2 X 50 questions | processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to questions | | |
|---|---|---|---|---|---|---|---|
| **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 **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | T- Method: Case Method Learning Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion | - Method: Case Method Learning Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and | **Material:** Meeting material 6 **Reference:** *Dr. R.P. Cantherford. Training Material on Weather Radar System* | 3% |

| # | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to 2 X 50 questions | processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to questions | | |
| 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<br>2. Can describe the types of noise in radar signals<br>3. Can find out the target signal criteria, threshold and noise signals on the radar<br>4. Can show the types of clutter in radar signals | **Criteria:** Activeness and correctness of material delivery<br><br>**Form of Assessment**: Participatory Activities | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. | **Material:** Meeting material 11 <br>**Bibliography:** *Merrill I. Skolnik. 2008. Radar Handbook, 3rd Edition. McGraw-Hill Education.* | 3% |

| | | | | Method/Activity (Lecturer) | Method/Activity (Student) | Material/Reader | Weight |
|---|---|---|---|---|---|---|---|
| | | | | discussion process, providing information if necessary, encouraging all active group members. Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to 2 X 50 questions | Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to questions | | |
| 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 | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members. Students. Discussing examples of cases | **Material:** Meeting material 12 **Reader:** *Michael Kolowole. 2002 . Radar System Peak Detection and Tracking. Newness* | 3% |

| | | | | attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to 2 X 50 questions | that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to questions | | |
|---|---|---|---|---|---|---|---|
| **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<br>2.Can explain examples of 3D Radar and antennas | **Criteria:** Presentation results and ability to explain material<br>**Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts | - Method: Case Method Learning<br><br>Step 1: Preparing Case Examples Basic Questions The lecturer asks: what are the public problems that arise, their causes and impacts? Students respond to lecturer's questions, question and answer Step 2: Determine discussion procedures (Individual/Ex) Lecturer determines collection procedures and time Lecturer makes agreement on deadline for collection, Gives students time to form groups Students Agree on schedule, Arrange groups, Step 3: Group Discussion Lecturer conducts observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing | **Material:** Meeting material 13 **Reader:** *BA Mahafza. 2000. Radar Systems Analysis and Design Using Matlab. Chapman & Hall/CRC, 2000* | 3% |

| No | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | observing/paying attention to the discussion process, providing information if necessary, encouraging all active group members . Students. Discussing examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to 2 X 50 questions | examples of cases that will be taken. Collecting and processing supporting data. Analyzing cases and their solutions. Preparing presentations. Step 4: Group Presentation. Lecturer examines the presentation, provides opportunities for questions and answers. Provides time. students to reflect and revise cases presented. Provide suggestions and input on case examples presented. Students collect discussion results according to the agreed time limit. Present and respond to questions | | |
| 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<br><br>**Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | Case Method 2 X 50 | Case Method | **Material:** Meeting material 14 **Bibliography:** *Merrill I. Skolnik. 2008. Radar Handbook, 3rd Edition. McGraw-Hill Education.* | 5% |
| 15 | Reviewing research related to Radar | Can explain scientific articles related to radar | **Criteria:** Activeness in conveying and understanding the material<br><br>**Form of Assessment** : Participatory Activities | Case Method 2 X 50 | Case Method | **Material:** Meeting material 15 **References:** | 5% |
| 16 | UAS | UAS | **Criteria:** Activeness and accuracy in answering questions<br><br>**Form of Assessment** : Project Results Assessment / Product Assessment, Test | UAS 2 X 50 | | **Material:** Meeting material 1-15 **Reference:** *Dr. R.P. Cantherford. Training Material on Weather Radar System* | 30% |

**Evaluation Percentage Recap: Case Study**

| No | Evaluation | Percentage |
|---|---|---|
| 1. | Participatory Activities | 25.67% |
| 2. | Project Results Assessment / Product Assessment | 41.67% |
| 3. | Practical Assessment | 1.67% |
| 4. | Test | 25% |
| | | 94.01% |

**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.