



**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
Wireless Communication Systems	2020102193		T=2	P=0	ECTS=3.18	5	July 17, 2024
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator	
	Pradini Puspitaningayu, Ph.D.		Prof. Dr. I Gusti Putu Asto Buditjahjanto, S.T., M.T.			Dr. Lusia Rakhmawati, S.T., M.T.	

<b>Learning model</b>	<b>Case Studies</b>
-----------------------	---------------------

<b>Program Learning Outcomes (PLO)</b>	<b>PLO study program which is charged to the course</b>																																																																																																																						
	<b>Program Objectives (PO)</b>																																																																																																																						
	<b>PO - 1</b>	Able to explain the basic principles of wireless communication systems and channels.																																																																																																																					
	<b>PO - 2</b>	Able to explain techniques and engineering of wireless communication systems, especially multiple access techniques, orthogonal modulation, MIMO.																																																																																																																					
	<b>PO - 3</b>	Able to explain technology and standards for wireless and mobile communication systems.																																																																																																																					
	<b>PO - 4</b>	Able to explain wireless and mobile communications network planning.																																																																																																																					
	<b>PO - 5</b>	Able to evaluate the performance of wireless communication networks.																																																																																																																					
	<b>PLO-PO Matrix</b>																																																																																																																						
		<table border="1" style="margin: auto;"> <tr><td>P.O</td></tr> <tr><td>PO-1</td></tr> <tr><td>PO-2</td></tr> <tr><td>PO-3</td></tr> <tr><td>PO-4</td></tr> <tr><td>PO-5</td></tr> </table>	P.O	PO-1	PO-2	PO-3	PO-4	PO-5																																																																																																															
	P.O																																																																																																																						
PO-1																																																																																																																							
PO-2																																																																																																																							
PO-3																																																																																																																							
PO-4																																																																																																																							
PO-5																																																																																																																							
<b>PO Matrix at the end of each learning stage (Sub-PO)</b>																																																																																																																							
	<table border="1" style="margin: auto;"> <thead> <tr> <th rowspan="2">P.O</th> <th colspan="16">Week</th> </tr> <tr> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th> </tr> </thead> <tbody> <tr><td>PO-1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>PO-2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>PO-3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>PO-4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>PO-5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	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																
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																																																																																																																							

<b>Short Course Description</b>	Conducting studies on wireless communication concepts, evolution of radio communications, basic antennas and propagation, cellular system design concepts: frequency reuse, cellular system capacity, grade of service (GoS), path loss propagation, outdoor and indoor propagation, multipath fading, channel coding and interleaving .
---------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<b>References</b>	<p><b>Main :</b></p> <ol style="list-style-type: none"> <li>1. T.S. Rappaport. 2003. Wireless Communications: Principles and Practice (2nd Edition). Prentice Hall.</li> <li>2. W. Stallings. 2005. Wireless Communications and Networks (2nd Edition). Wiley.</li> <li>3. C.A. Balanis. 2005. Antenna Theory Analysis and Design (3rd Edition). Wiley.</li> </ol> <p><b>Supporters:</b></p>
-------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<b>Supporting lecturer</b>		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	Able to understand the basic concepts of wireless communication systems and their development	1. Able to understand Wireless Communication Systems, for Baseband and Radio Frequency components. 2. Able to understand the Characteristics of Mobile Radio Channels. 3. Able to understand narrow band communication systems and wide band communication systems, including Spread spectrum, CDMA, OFDM.	<b>Criteria:</b> 1. The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.  <b>Form of Assessment :</b> Participatory Activities	Presentation, group discussion and reflection 2 X 50			2%

2	Able to understand the basic concepts of wireless communication systems and their development	<p>1.Able to understand Wireless Communication Systems, for Baseband and Radio Frequency components.</p> <p>2.Able to understand the Characteristics of Mobile Radio Channels.</p> <p>3.Able to understand narrow band communication systems and wide band communication systems, including Spread spectrum, CDMA, OFDM.</p>	<p><b>Criteria:</b></p> <p>1.The assessment criteria are carried out by looking at aspects:</p> <p>2.1. Participation: carried out by observing student activities (weight 2)</p> <p>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)</p> <p>4.3. UAS: carried out every semester to measure all indicators (weight 3)</p> <p>5.4. Task: carried out on each indicator (weight 3)</p> <p>6.Student Final Grade:</p> <p>7.Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.</p> <p><b>Form of Assessment</b> : Participatory Activities</p>	Presentation, group discussion and reflection 2 X 50			5%
3	Able to understand the basic concepts of wireless communication systems and their development	<p>1.Able to understand Wireless Communication Systems, for Baseband and Radio Frequency components.</p> <p>2.Able to understand the Characteristics of Mobile Radio Channels.</p> <p>3.Able to understand narrow band communication systems and wide band communication systems, including Spread spectrum, CDMA, OFDM.</p>	<p><b>Criteria:</b></p> <p>1.The assessment criteria are carried out by looking at aspects:</p> <p>2.1. Participation: carried out by observing student activities (weight 2)</p> <p>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)</p> <p>4.3. UAS: carried out every semester to measure all indicators (weight 3)</p> <p>5.4. Task: carried out on each indicator (weight 3)</p> <p>6.Student Final Grade:</p> <p>7.Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.</p> <p><b>Form of Assessment</b> : Participatory Activities</p>	Presentation, group discussion and reflection 2 X 50			5%

4	Students are able to understand the large-scale path loss radio propagation model	<ol style="list-style-type: none"> <li>1.- Describe the radio propagation model</li> <li>2.- Describe reflection, two-ray model, diffraction, scattering</li> <li>3.- Describe the budget link design</li> <li>4.- Describe the outdoor propagation model</li> <li>5.- Describe the indoor propagation model</li> </ol>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1.The assessment criteria are carried out by looking at aspects: <ol style="list-style-type: none"> <li>2.1. Participation: carried out by observing student activities (weight 2)</li> <li>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)</li> <li>4.3. UAS: carried out every semester to measure all indicators (weight 3)</li> <li>5.4. Task: carried out on each indicator (weight 3)</li> </ol> </li> <li>6.Student Final Grade:</li> <li>7.Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.</li> </ol> <p><b>Form of Assessment :</b> Participatory Activities</p>	Presentation, group discussion and reflection 2 X 50			5%
5	Students are able to understand the large-scale path loss radio propagation model	<ol style="list-style-type: none"> <li>1.- Describe the radio propagation model</li> <li>2.- Describe reflection, two-ray model, diffraction, scattering</li> <li>3.- Describe the budget link design</li> <li>4.- Describe the outdoor propagation model</li> <li>5.- Describe the indoor propagation model</li> </ol>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1.The assessment criteria are carried out by looking at aspects: <ol style="list-style-type: none"> <li>2.1. Participation: carried out by observing student activities (weight 2)</li> <li>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)</li> <li>4.3. UAS: carried out every semester to measure all indicators (weight 3)</li> <li>5.4. Task: carried out on each indicator (weight 3)</li> </ol> </li> <li>6.Student Final Grade:</li> <li>7.Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.</li> </ol> <p><b>Form of Assessment :</b> Participatory Activities</p>	Presentation, group discussion and reflection 2 X 50			5%

6	Students are able to understand outdoor and indoor propagation models	<p>1.- Explain and mechanism of indoor propagation</p> <p>2.- Explain and design indoor propagation model simulations</p>	<p><b>Criteria:</b></p> <p>1.The assessment criteria are carried out by looking at aspects:</p> <p>2.1. Participation: carried out by observing student activities (weight 2)</p> <p>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)</p> <p>4.3. UAS: carried out every semester to measure all indicators (weight 3)</p> <p>5.4. Task: carried out on each indicator (weight 3)</p> <p>6.Student Final Grade:</p> <p>7.Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Presentations, group discussions, simulations and reflections 2 X 50			5%
7	Students are able to understand outdoor and indoor propagation models	<p>1.- Explain and mechanism of indoor propagation</p> <p>2.- Explain and design indoor propagation model simulations</p>	<p><b>Criteria:</b></p> <p>1.The assessment criteria are carried out by looking at aspects:</p> <p>2.1. Participation: carried out by observing student activities (weight 2)</p> <p>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)</p> <p>4.3. UAS: carried out every semester to measure all indicators (weight 3)</p> <p>5.4. Task: carried out on each indicator (weight 3)</p> <p>6.Student Final Grade:</p> <p>7.Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Presentations, group discussions, simulations and reflections 2 X 50			5%

8	Students are able to understand outdoor and indoor propagation models	<p>1.- Explain the concept of wireless communication systems, baseband components, and radio frequencies</p> <p>2.- Explain the concept of large-scale propagation (outdoor propagation)</p> <p>3.- Explain the concept of small-scale propagation (indoor propagation)</p>	<p><b>Criteria:</b></p> <p>1.The assessment criteria are carried out by looking at aspects:</p> <p>2.1. Participation: carried out by observing student activities (weight 2)</p> <p>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)</p> <p>4.3. UAS: carried out every semester to measure all indicators (weight 3)</p> <p>5.4. Task: carried out on each indicator (weight 3)</p> <p>6.Student Final Grade:</p> <p>7.Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.</p> <p><b>Form of Assessment</b> : Test</p>	Test/quiz 2 X 50			20%
9	Wireless Communications Technology and Standards	<p>1.Able to recognize second generation Wireless Communication Technology and Standards (GSM, ETSI Standard)</p> <p>2.Able to explain broadband wireless technology, third generation family (3GPP: WCDMA, HSPA and 3GPP2: CDMA 2000)</p> <p>3.Able to recognize fourth and next generation (LTE) technologies and standards</p> <p>4.Able to explain IEEE wireless technology and standards: 802.11, 802.15 and 802.16</p>	<p><b>Form of Assessment</b> : Participatory Activities</p>	Presentations, group discussions and reflections			2%

10	Wireless Communications Technology and Standards	<ol style="list-style-type: none"> <li>1. Able to recognize second generation Wireless Communication Technology and Standards (GSM, ETSI Standard)</li> <li>2. Able to explain broadband wireless technology, third generation family (3GPP: WCDMA, HSPA and 3GPP2: CDMA 2000)</li> <li>3. Able to recognize fourth and next generation (LTE) technologies and standards</li> <li>4. Able to explain IEEE wireless technology and standards: 802.11, 802.15 and 802.16</li> </ol>	<b>Form of Assessment</b> : Participatory Activities	Presentations, group discussions and reflections			2%
11	Mastering wireless communication network planning	<ol style="list-style-type: none"> <li>1. Able to explain wireless communication network planning</li> <li>2. Able to analyze System and Device Requirements Planning based on design methodology.</li> </ol>	<b>Form of Assessment</b> : Participatory Activities	Presentations, group discussions and reflections			2%
12	Mastering wireless communication network planning	<ol style="list-style-type: none"> <li>1. Able to explain wireless communication network planning</li> <li>2. Able to analyze System and Device Requirements Planning based on design methodology.</li> </ol>	<b>Form of Assessment</b> : Participatory Activities	Presentations, group discussions and reflections			2%
13	Mastering wireless communication network planning	<ol style="list-style-type: none"> <li>1. Able to explain wireless communication network planning</li> <li>2. Able to analyze System and Device Requirements Planning based on design methodology.</li> </ol>		Presentations, group discussions and reflections			5%

14	Evaluate the performance of wireless communication networks	1.Able to explain the performance of Wireless Communication networks, introduce performance parameters, measuring tools and analyzers 2.Able to measure network performance and analyze performance	<b>Form of Assessment</b> : Participatory Activities	lecture, discussion	lecture, discussion		5%
15	Evaluate the performance of wireless communication networks	1.Able to explain the performance of Wireless Communication networks, introduce performance parameters, measuring tools and analyzers 2.Able to measure network performance and analyze performance	<b>Form of Assessment</b> : Participatory Activities	lecture, discussion	lecture, discussion		5%
16		1.Able to explain Wireless Communication Technology and Standards 2.Able to demonstrate wireless communication network planning 3.Able to evaluate the performance of wireless communication networks	<b>Form of Assessment</b> : Test	test/quiz			30%

#### Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Test	50%
		100%

#### Notes

- 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.
- 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.
- 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.
- 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.
- Indicators for assessing** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities or performance of student learning outcomes accompanied by evidence.
- 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.
- Forms of assessment:** test and non-test.
- 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.