	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Bachelor of Science Education Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Waves and Optics	8420103049		T=3	P=0	ECTS=4.77	3	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Erman, M.Pd.

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-5	Demonstrate scientific, critical, and innovative attitudes in integrated science learning, laboratory activities, and professional-related tasks
	PLO-11	Design and conduct research about learning of integrated science, and acquire, analyze, and interpret the research data
	PLO-13	Demonstrate knowledge of integrated science (physics, chemistry, and biology)
	Program Objectives (PO)	
	PO - 1	Able to show a responsible attitude, demonstrate a scientific, critical and innovative attitude independently during the lecture process
	PO - 2	Able to master the basic substantive concepts of vibration, waves, light, optical devices and their application to solve problems in everyday life
	PO - 3	Able to demonstrate independent, quality and measurable performance as well as make appropriate decisions and be able to work individually or in a team
	PLO-PO Matrix	

P.O	PLO-5	PLO-11	PLO-13
PO-1			
PO-2			
PO-3			

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																

Short Course Description	This course examines the basics of vibrations, waves, light, optical devices and their application in everyday life. Presented in the form of theory and practice.
References	**Main :**

1. Matakuliah ini mengaji dasar-dasar getaran, gelombang, cahaya, alat optic dan penerapannya dalam kehidupan sehari-hari.Disajikan dalam bentuk teori dan praktek.
2. Referensi:
3. Bass, Michael. 1995. Hand Book Of Optics. United States: McGraw-Hill Office
4. Crowell, Benjamin. 2003. Vibrations and Waves. California: Fullerrton
5. Giancoli, Douglas. 2014. Physics: Principles with Applications Ed 7E. California: Addison-Wesley.
6. Giancoli, Douglas. 2010. Fisika II. Jakarta: Erlangga.
7. Sahara Muslim. 2004. Gelombang dan Optik.Jakarta : Depdikbud Dikti

	Supporters:	
Supporting lecturer	Prof.Dr. Wahono Widodo, M.Si. Dr. Mohammad Budiyanto, S.Pd., M.Pd. Tutut Nurita, S.Pd., M.Pd. Laily Rosdiana, S.Pd., M.Pd. An Nuril Maulida Fauziah, S.Pd., M.Pd. Muhamad Arif Mahdiannur, S.Pd., M.Pd. Dyah Permata Sari, S.Pd., M.Pd.	

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	Analyzing vibration symptoms to solve relevant problems, making strategic decisions based on data and information, being responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems	1. Analyze the properties of vibrations. 2. Derive the vibration formula equation. 3. Carrying out scientific method steps in solving examples of vibration problems 4. Prepare practical reports related to vibration 5. Utilizing science and technology to describe the time deviation function of vibrations	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Forms of Assessment** : Participatory Activities, Practical Assessment, Tests	Case based learning and peer interaction 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Vibrations References **:** *Bueche, FJ (2000). Schaum's outline of college physics. Mc Graw-Hill.* **Material:** Vibration Reader **:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.*	10%
2	Analyzing the symptoms of damped vibrations to solve relevant problems, making strategic decisions based on data and information, being responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems	1. Analyzing damped vibrations 2. Describe the equation for damped vibration 3. Utilizing science and technology to describe the time deviation function of damped vibrations	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities, Tests	Case based learning and peer interaction 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Vibrations References **:** *Bueche, FJ (2000). Schaum's outline of college physics. Mc Graw-Hill* **Material:** Vibration Reader **:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.*	5%

3	Analyze the symptoms of vibration resonance and vibration superposition to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems	1. Analyzing vibration resonance 2. Analyzing vibration superposition 3. Utilizing science and technology to describe the time deviation function of vibration resonance and vibration superposition	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities, Tests	Case based learning and peer interaction 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Vibration Reader **:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.* **Material:** Vibration Reader **:** *Crowell, Benjamin. (2003). Vibrations and Waves. California: Fullerton*	5%
4	Analyzing wave symptoms to solve relevant problems, making strategic decisions based on data and information, being responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems	1. Analyze the properties of waves 2. Derive the wave formula equation 3. Carry out the steps of the scientific method in solving examples of wave problems 4. Prepare practical reports related to waves 5. Utilizes science and technology to describe waves	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Forms of Assessment** : Participatory Activities, Practical Assessment, Tests	Case based learning and peer interaction 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Waves **Bibliography:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.* **Material:** Waves **Literature:** *Crowell, Benjamin. (2003). Vibrations and Waves. California: Fullerton* **Material:** Bibliography Wave **:** *Muslim Sahara. (2004). Waves and Optics. Jakarta: Depdikbud Dikti* **Material:** Waves **Literature:** *Bueche, FJ(2000). Schaum‘s outline of college physics. Mc Graw-Hill*	10%

5	Analyzing the symptoms of harmonic waves to solve relevant problems, making strategic decisions based on data and information, being responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems	1. Analyzing harmonic waves 2. Analyze the superposition and interference of harmonic waves 3. Derive the formula for superposition and harmonic wave interference 4. Utilizing science and technology to describe harmonic waves	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities	Case based learning 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Harmonic Waves **References:** *Crowell, Benjamin. (2003). Vibrations and Waves. California: Fullerton* **Material:** Harmonic Waves **References:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.*	5%
6	Analyze the symptoms of standing waves to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks, and agreements with the team, by utilizing science and technology in solving problems	1. Analyzing standing waves 2. Derived the standing wave formula 3. Leveraging science and technology to describe standing waves	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities, Tests	Case based learning 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Waves **Literature:** *Crowell, Benjamin. (2003). Vibrations and Waves. California: Fullerton* **Material:** Waves **Bibliography:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.*	5%
7	Analyze the symptoms of standing wave superposition to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems	1. Analyzing the superposition of standing waves 2. Derive the standing wave superposition formula equation 3. Leveraging science and technology to describe the superposition of standing waves	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities, Tests	Case based learning 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Waves **Literature:** *Crowell, Benjamin. (2003). Vibrations and Waves. California: Fullerton* **Material:** Waves **Bibliography:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.*	5%
8	-	Sub-CMPK 1st to 7th Meetings	**Criteria:** Accuracy and mastery according to the UTS assessment indicators (assessment rubric). **Form of Assessment** : Test	Mid-Semester Evaluation/Mid-Semester Examination (UTS) 2 X 50‘		**Material:** - **Library:**	0%

9	Analyze sounds to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems	1. Analyze the characteristics of sound (properties of sound) associated with waves. 2. Analyze sound sources (strings and air columns) 3. Describe the mechanisms of human hearing 4. Carry out the steps of the scientific method in solving sound sample problems 5. Prepare practical reports related to sound 6. Utilizing science and technology to solve problems related to sound	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Forms of Assessment** : Participatory Activities, Practical Assessment, Tests	Case based learning 3 x 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 X 60‘	**Material:** Bibliography **:** *Crowell, Benjamin. (2003). Vibrations and Waves. California: Fullerton* **Material:** Bibliography **:** *Bueche, FJ(2000). Schaum's outline of college physics. Mc Graw-Hill* **Material:** Bibliography **:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.*	10%
10	Analyze sound quality, interference and Doppler effects to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks and agreements with the team, by utilizing science and technology in solving problems.	1. Analyze sound quality 2. Analyzing sound interference 3. Analyzing the Doppler effect. 4. Utilizing science and technology to describe the occurrence of the doppler effect	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities, Tests	Case based learning 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Bibliography **:** *Crowell, Benjamin. (2003). Vibrations and Waves. California: Fullerton* **Material:** Bibliography **:** *Giancoli, Douglas. (2014). Physics: Principles with Applications Ed 7E. California: Addison-Wesley.* **Material:** Bibliography **:** *Sahara Muslim. (2004). Waves and Optics. Jakarta: Depdikbud Dikti*	5%
11	Analyze light as electromagnetic waves to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks, and agreements with the team, by utilizing science and technology in solving problems.	1. Analyze light as electromagnetic waves and the electromagnetic spectrum 2. Calculating the speed of light 3. Carry out the steps of the scientific method in solving examples of light problems 4. Compile a practical report related to light 5. Leveraging science and technology to solve problems related to light	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Forms of Assessment** : Participatory Activities, Practical Assessment, Tests	Case based learning and peer-interaction 3 x 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 X 60‘	**Material:** Light **Literature:** *Giancoli, Douglas. (2010). Physics II. Jakarta: Erlangga.* **Material:** Light **Library:** *Bueche, FJ (2000). Schaum's outline of college physics. Mc Graw-Hill*	10%

12	Analyzing light as geometric optics for solving relevant problems, making strategic decisions based on data and information, being responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems.	1. Analyze the formation of images due to the reflection of light in the mirror 2. Analyze the formation of images due to refraction of light in the lens 3. Carry out the steps of the scientific method in completing the reflection of light in mirrors and the refraction of light in lenses 4. Compile a practical report related to the reflection and refraction of light 5. Utilizes science and technology to describe the reflection and refraction of light	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Forms of Assessment** : Participatory Activities, Practical Assessment, Tests	Case based learning and peer-interaction 3 X 50'	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60'	**Material:** Light **Literature:** *Giancoli, Douglas. (2010). Physics II. Jakarta: Erlangga.* **Material:** Light **Library:** *Bueche, FJ (2000). Schaum's outline of college physics. Mc Graw-Hill*	10%
13	Analyze the nature of waves in light to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks, and agreements with the team, by utilizing science and technology in solving problems.	1. Analyze the wave properties of light (diffraction, interference and polarization) 2. Utilizing science and technology to describe the wave nature of light	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities, Tests	Case based learning and peer-interaction 3 X 50'	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60'	**Material:** Light **Literature:** *Giancoli, Douglas. (2010). Physics II. Jakarta: Erlangga.* **Material:** Light **Library:** *Bueche, FJ (2000). Schaum's outline of college physics. Mc Graw-Hill*	5%
14	Analyze optical tools (camera and human eye) to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems.	1. Analyzing image formation and its properties in equipment that utilizes light, including cameras and the human eye 2. Utilizing science and technology to describe image formation in cameras and the human eye	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities, Tests	Case based learning and peer-interaction 3 X 50'	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60'	**Material:** Optics **Reader:** *Bass, Michael. (1995). Hand Book Of Optics. United States: McGraw-Hill Office* **Material:** Optics **Library:** *Sahara Muslim. (2004). Waves and Optics. Jakarta: Depdikbud Dikti* **Material:** Optics **Bibliography:** *Bueche, FJ(2000). Schaum's outline of college physics. Mc Graw-Hill*	5%

15	Analyze optical tools (glasses, scopes, microscopes and binoculars) to solve relevant problems, make strategic decisions based on data and information, be responsible for self-learning, tasks, and agreements with his team, by utilizing science and technology in solving problems.	1. Analyze the formation of images and their properties in equipment that uses light, including glasses, louvers, microscopes and binoculars 2. Make decisions about the use of optical equipment and the power of the lenses selected for a particular application 3. Utilizing science and technology to describe the formation of images in glasses, loupes, microscopes and binoculars	**Criteria:** Accuracy and mastery according to assessment indicators (assessment rubric) **Form of Assessment** : Participatory Activities, Tests	Case based learning and peer-interaction 3 X 50‘	Case based learning and peer-interaction (synchronous) via Zoom/Google Meet Asynchronous via LMS Unesa 3 x 60‘	**Material:** Optics **Reader:** *Bass, Michael. (1995). Hand Book Of Optics. United States: McGraw-Hill Office* **Material:** Optics **Bibliography:** *Giancoli, Douglas. (2010). Physics II. Jakarta: Erlangga.* **Material:** Optics **Bibliography:** *Bueche, FJ(2000). Schaum‘s outline of college physics. Mc Graw-Hill*	10%
16	-	Sub-CMPK 1 to 15	**Criteria:** Accuracy and mastery according to the UAS assessment indicators (assessment rubric). **Form of Assessment** : Test	Final Semester Evaluation/Final Semester Exam 2 x 50‘		**Material:** - **Library:**	0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	44.15%
2.	Practical Assessment	16.65%
3.	Test	39.15%
		99.95%

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** 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.
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.