SEMESTER LEARNING ACTIVITY PLANS
(SLAP)
SEMESTER EVEN 2022/2023

Laser Physics

MFF5426 / 2 Credits

Lecturer Coordinator:

Prof. Dr. Agung Bambang Setio Utomo, S.U.

UNIVERSITAS GADJAH MADA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
2022

Universitas Gadjah Mada
Faculty of Mathematics and Natural Science
Physics Department / Study Program Master Physics
Semester Even 2022/2023

SEMESTER LEARNING ACTIVITY PLANS (SLAP)

Code	Course Name	Credits (credits)	Semester	Status	Prerequisite
MFF5426	*Laser Physics*	*2*	*Even*	*Elective*	*None*

Short Description

Laser Physics course is Elective course 2 credits (Theory) in the 2022 Curriculum Master Physics Study Program, Faculty of Mathematics and Natural Science UGM.

The syllabus of this course is as follows:
Introduction: Interaction of electromagnetic radiation with matter, quantization of electromagnetic fields. Laser principle: active laser material, pumping mechanism, optical resonator, optical radiation modulation, Q-switching, mode locking. Laser characterization: laser type, laser properties, laser classes, laser hazards, and how to deal with them. Laser Applications: in spectroscopy, agriculture, communication, medicine, industry, etc.

The courses are held in class for 14 weeks, each week's session last for 2 x 50 minutes. Four weeks of course period is used for Midterm Exam and Final Exam, each held for two weeks as scheduled.

Student evaluation for course assessments is performed summative and formative. The summative evaluation is implemented as written exams, both Midterm and Final Exam, which take a maximum of 120 minutes. The formative evaluation is implemented as individual assignments for each student in the form of completing an assignment individually. Monitoring is carried out by observing student activities during the course, such as attendance, Q&A and discussion about the material presented, and student performance in completing individual assignments.

Program Learning Outcomes (PLO) Imposed on the Course

PLO 3	Mastering further knowledge of classical and modern physics theory, and its relationship with other disciplines, and has mastered an advanced field of physics specialization that allows him to keep up with the latest international research developments.
PLO 4	Mastering various mathematical disciplines related to an advanced field of physics, and able to develop physical models using various mathematical and computational tools with an inter or multidisciplinary approach to solving problems related to an advanced field of physics.
PLO 6	Able to apply knowledge to analyze, synthesize, formulate problems and solve problems comprehensively in one of advanced field of physics, through experimental or theoretical research, then be able to classify and draw conclusions about their findings for the development of science and technology.

Upon completion of this course, students should be able to:

Course Outcomes (CO)	***CO1***	Understand the mechanism of electron interaction in atoms so that students can use lasers, electronic auxiliary equipment and their use.		
	CO2	Have an adequate understanding of the use of lasers for applications and analysis involving laser beam radiation.		
	CO3	Increase cooperation in groups and the ability to convey ideas or thoughts, also improve the ability to think logically and creatively, which will indirectly foster leadership spirit through group work/discussion.		
	CO4	Have skills in obtaining lecture materials from lectures provided by lecturers and other materials by searching through library books and the internet.		
	CO5			
	CO6			
	CO7			
	CO8			
The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1	Introduction	Lecture, discussion	2 x 50 minutes
	CO1	Quantization of light and the interaction of electromagnetic radiation with matter.	Lecture, discussion	2 x 50 minutes
	CO1	Quantization of light and the interaction of electromagnetic radiation with matter.	Lecture, discussion	2 x 50 minutes
	CO2	Quantization of light and the interaction of electromagnetic radiation with matter.	Lecture, discussion	2 x 50 minutes
	CO2	atomic process	Lecture, discussion	2 x 50 minutes
	CO2	Atomic Process	Lecture, discussion	2 x 50 minutes
	CO2	Laser working principle	Lecture, discussion	2 x 50 minutes
	CO3	Optical Pumping Principle	Lecture, discussion	2 x 50 minutes
	CO3	Optical resonator working principle	Lecture, discussion	2 x 50 minutes
	CO3	Types, properties, characteristics of lasers and laser beams.	Lecture, discussion	2 x 50 minutes
	CO4	Types, properties, characteristics of lasers and laser beams.	Lecture, discussion	2 x 50 minutes
	CO4	Laser app	Lecture, discussion	2 x 50 minutes
	CO4	Laser app	Lecture, discussion	2 x 50 minutes
	CO4	Laser app	Lecture, discussion	2 x 50 minutes
	Final Exam/ Project Task Results/ Case Analysis Results			

<table>
<tr><td>Learning Methods</td><td>Lecture, discussion</td></tr>
<tr><td>Student Learning Experience</td><td>Learn to analyze and review: Introduction, Quantization of light and the interaction of electromagnetic radiation with matter., Quantization of light and the interaction of electromagnetic radiation with matter., Quantization of light and the interaction of electromagnetic radiation with matter., atomic process, Atomic Process, Laser working principle, Optical Pumping Principle, Optical resonator working principle, Types, properties, characteristics of lasers and laser beams., Types, properties, characteristics of lasers and laser beams., Laser app, Laser app, Laser app.</td></tr>
<tr><td>Access to Learning Media/ LMS and Offline and Online Percentage</td><td></td></tr>
<tr><td>Assessment Methods and Synchronization with CO</td><td>
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<tr><th>Assessment Methods</th><th>Assessment Percentage</th><th>Criteria/Indicators</th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th></tr>
<tr><td>Participatory Activity*</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Project Results/ Case Study Results/ PBL Results*</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Cognitive</td></tr>
<tr><td>Assignment</td><td>30%</td><td></td><td>7,5%</td><td>7,5%</td><td>7,5%</td><td>7,5%</td></tr>
<tr><td>Quiz</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Midterm Exam</td><td>35%</td><td></td><td>17,5%</td><td>17,5%</td><td></td><td></td></tr>
<tr><td>Final Exam</td><td>35%</td><td></td><td></td><td></td><td>17,5%</td><td>17,5%</td></tr>
<tr><td colspan="7">*) can also be obtained from the Midterm or Final Exam as the result of participatory activities or project/ case study results. According to IKU 7, the percentage of project results/ case study/ PBL results is at least 50%.</td></tr>
</table>
</td></tr>
<tr><td>References</td><td>Main references:
1. Loudon, R.., 1985, Quantum Theory of Light, 2nd ed., Oxford UniversityPress.
2. Yariv, A., 1989, Quantum Electronics, 3rd ed., John Wiley & Sons.
3. Svelto, O., 1989, Principles of Laser, 3rd ed. (translation in English by D.C.Hanna), Plenum Press.
4. Miloni P.W. and Eberly H., 1991, Lasers, John and Willey.
5. Shimoda K., 1986, Introduction to Laser Physics, Springer Verlag.</td></tr>
<tr><td>Lecturers (Team Teaching)</td><td>1. Prof. Dr. Agung Bambang Setio Utomo, S.U.
2. Dr. Moh. Ali Joko Wasono, M.S.
3.
4.</td></tr>
<tr><td>Authorization</td><td>
<table>
<tr><th>Date of Drafting</th><th>Lecturer Coordinator</th><th>Head of Curriculum Committee</th><th>Head of Study Program</th></tr>
<tr><td></td><td>Prof. Dr. Agung Bambang Setio Utomo, S.U.</td><td>Dr.Ing. Ari Setiawan</td><td>Mirza Satriawan, M.Si., Ph.D</td></tr>
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