# SEMESTER LEARNING ACTIVITY PLANS (SLAP)

## SEMESTER ODD 2022/2023

Physics Undergraduate Study Program

Physics Department

Introduction to Laser Physics

MFF 3423/ 2 Credits


Lecturer Coordinator:

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**UNIVERSITAS GADJAH MADA**
**FACULTY OF MATHEMATICS AND NATURAL SCIENCE**
**2022**

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| | **Universitas Gadjah Mada**<br>Faculty of Mathematics and Natural Science<br>Physics Department / Physics Undergraduate Study Program<br>Semester ODD 2022/2023 | **Document Number :**<br>…… |

**SEMESTER LEARNING ACTIVITY PLANS (SLAP)**

| Code | Course Name | Credits (Credits) | | Semester | Status | Prerequisite |
|---|---|---|---|---|---|---|
| *MFF 3423* | *Introduction to Laser Physics* | *T: 2* | *P: …* | *ODD* | *Elective* | *Electromagnetics I (MFF 2415), Quantum Physics I (MFF 2034), Atomic and Molecular Physics (MFF 2310)* |

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| **Short Description** | The introduction to laser physics course is an elective subject of interest in the Physics study program, Department of Physics, FMIPA-UGM. This course will provide material on the basics of transitions in electrons in atoms with material that will be very useful in understanding the mechanisms that occur in lasers. Besides that, the material for the welding process was also given, including increasing the lasing intensity of a laser with or without assistive devices. The material on types of lasers and their applications in industry, research, trade, and others are also given as a compliment. With good mastery of the material in this course and supported by atomic physics practicum courses (experimental physics I a and B), it will improve students' attitudes, so they can increase their value in entering the world of work. This course has a very strategic position because it requires an understanding of several other subjects such as physics measurement methods, modern physics of atomic physics, and others, as well as being a support for subsequent courses, especially courses involving laser interaction (Laser Spectroscopy) and final projects for students who involve a physical laser as well as a laser as a light source. | |
| **Program Learning Outcomes (PLO) Imposed on the Course** | ***PLO 2*** | Knowledge. Able to explain theoretical concepts and principles of classical and modern physics and able to apply basic concepts of physics and related mathematical methods in finding solutions to physical problems. |
| | ***PLO 5*** | Long Life Learning. Able to analyze various alternative solutions to physical problems and conclude them for appropriate decision-making, both in familiar and new problems. |
| **Course Outcomes (CO)** | **After completing this course, students are expected to be able to:** | |
| | ***CO1*** | Understand the mechanism of electron interaction in atoms so that students can use lasers, electronic assistive devices, and their uses. |
| | ***CO2*** | Have an adequate understanding of the use of lasers for applications and analysis involving laser light radiation. |
| | ***CO3*** | Increase cooperation in groups and the ability to convey ideas or thoughts, as well as improve the ability to think logically and creatively, which will indirectly foster leadership through group work. |
| | ***CO4*** | Have skills in obtaining lecture materials from lectures provided by lecturers and other materials by searching through library books and the internet. |

| | | Learning Materials | Learning Methods | Time Allocation |
|---|---|---|---|---|
| **The Correlation of CO to Learning Materials and** | ***CO1, CO2 CO3, CO4*** | Introduction: Lecture game rules, assessment rules, Material (Syllabus) | TCL-SCL mixed | ***2X50 minutes*** |

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| **Methods, and Time Allocation** | ***CO1, CO2 CO3, CO4*** | Light quantization | TCL-SCL mixed | ***2X50 minutes*** |
| | ***CO1, CO2 CO3, CO4*** | Properties of gas atoms | TCL-SCL mixed | ***2X50 minutes*** |
| | ***CO1, CO2 CO3, CO4*** | The interaction of electromagnetic radiation with matter | TCL-SCL mixed | ***2X50 minutes*** |
| | ***CO1, CO2 CO3, CO4*** | Atomic transition processes: absorption, spontaneous emission, and forced emission of radiation | TCL-SCL mixed | ***2X50 minutes*** |
| | ***CO1, CO2 CO3, CO4*** | Laser working principle | TCL-SCL mixed | ***2X50 minutes*** |
| | ***CO1, CO2 CO3, CO4*** | Optical pumping mechanism as a condition for the welding process | TCL-SCL mixed | ***2X50 minutes*** |
| | **Midterm exam/Project Task Results/Case Analysis Results** | | | |
| | ***CO1, CO2 CO3, CO4*** | Optical resonator mechanism and function | TCL-SCL mixed | ***4X50 minutes*** |
| | ***CO1, CO2 CO3, CO4*** | Types, properties, and characteristics of lasers and laser beams made from active gases, solids, liquids, and semiconductors | TCL-SCL mixed | ***6X50 minutes*** |
| | ***CO1, CO2 CO3, CO4*** | Laser app | TCL-SCL mixed | ***4X50 minutes*** |
| | **Final exams/ Project Task Results/Case Analysis Results** | | | |
| **Learning Methods** | **SCL (Student Centered Learning): Project-based learning (Team-based Project)/Case-based learning/PBL/other SCL methods** | | | |
| **Student Learning Experience** | **Listen, ask, answer questions and discuss** | | | |
| **Access to Learning Media/ LMS and Offline and Online Percentage** | Offline (LCD, PPT Slide, Whiteboard, Laptop) and Online (Zoom Meeting, Google Meet, Google Classroom) | | | |

| **Assessment Methods and Synchronization with CO** | **Assessment Methods** | **Assessment Percentage** | **Criteria/ Indicators** | **CO1** | **CO2** | **CO3** | **CO4** |
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| | **Participatory Activity*** | | | | | | |
| | **Project Results/ Case Study Results/ PBL Results*** | | | | | | |
| | **Cognitive** | | | | | | |
| | **Assignment** | **20** | | √ | √ | √ | √ |
| | **Midterm Exam** | **40** | | √ | √ | √ | √ |
| | **Final Exam** | **40** | | √ | √ | √ | √ |
| | **Total** | **100** | | | | | |

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| | *) 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%. |
| **References** | **Main References;**<br>1. Svelto O, 1989, Principles of Lasers, Plenum Press..<br>2. Milonni PW dan Eberly H, 1991, Lasers, John Wiley.. |
| **Lecturers (*Team Teaching*)** | 1. Dr. Moh. Ali Joko Wasono, M.S.<br>2. Prof. Dr. Agung Bambang Setio Utomo, S.U. |

| **Authorization** | **Date of Drafting** | **Lecturer Coordinator** | **Head of Curriculum Committee** | **Head of Study Program** |
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| | | *Dr. Moh. Ali Joko Wasono, M.S.* | | *Dr. Eng. Ahmad Kusumaatmaja, S.Si., M.Sc.* |