SEMESTER LEARNING ACTIVITY PLANS (SLAP)

SEMESTER ODD 2022/2023

Physics Undergraduate Study Program

Physics Department

Metrology and Calibration in Physics

MFF 2061/ 3 Credits

Lecturer Coordinator:

Prof. Dr. Eng. Kuwat Triyana, M.Si

UNIVERSITAS GADJAH MADA

FACULTY OF MATHEMATICS AND NATURAL SCIENCE

2022

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

SEMESTER LEARNING ACTIVITY PLANS (SLAP)

Code	Course Name	Credits (Credits)		Semester	Status	Prerequisite
MFF 2061	*Metrology and Calibration in Physics*	*T: 3*	*P: …*	*ODD*	*Elective*	*Measurement Technique in Physics (MFF 1061)*

Short Description	The Metrology and Calibration in Physics courses are elective courses of 3 credits in the 2021 curriculum of the Physics Undergraduate Study Program, Universitas Gadjah Mada, which can be taken in Odd semesters. To be able to take this course, students are recommended to have completed the Physics measurement method course. In the 2021 Curriculum of the Physics Undergraduate Study Program, this course is associated with competencies in the Knowledge Aspect (PLO 2) and the Long Life Learning/Self-Development Aspect (PLO 5).

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	Know and understand quality infrastructure, national standard systems, and international standard systems
	CO2	Knowledge of metrology and metrology organization, units and traceability, scientific and industrial metrology, and nanometrology.
	CO3	Know and understand measurement uncertainty and basic principles of calibration
	CO4	Know and understand about calibration of dimensional measuring instruments, calibration of temperature measuring instruments, calibration of time measuring instruments, and calibration of analytical instruments

		Learning Materials	Learning Methods	Time Allocation
The Correlation of CO to Learning Materials and Methods, and Time Allocation	***CO 1***	Quality infrastructure	TCL-SCL mixed	***3X50 minutes***
	CO 1	National Standard System	TCL-SCL mixed	***3X50 minutes***
	CO 1	International standard system	TCL-SCL mixed	***3X50 minutes***
	CO 2	Metrology and metrology organization	TCL-SCL mixed	***3X50 minutes***
	CO 2	Metrological units and traceability	TCL-SCL mixed	***3X50 minutes***
	CO 2	Scientific and industrial metrology	TCL-SCL mixed	***3X50 minutes***
	CO 2	Nano-Metrology	TCL-SCL mixed	***3X50 minutes***
	Midterm exam/Project Task Results/Case Analysis Results			
	CO 3	Measurement Uncertainty	TCL-SCL mixed	***3X50 minutes***
	CO 3	Basic principles of calibration	TCL-SCL mixed	***3X50 minutes***

	CO 4	Mass measuring instrument calibration	TCL-SCL mixed	***3X50 minutes***
	CO 4	Dimension measuring instrument calibration	TCL-SCL mixed	***3X50 minutes***
	CO 4	temperature measuring instrument calibration	TCL-SCL mixed	***3X50 minutes***
	CO 4	time gauge calibration	TCL-SCL mixed	***3X50 minutes***
	CO 4	Calibration of analytical instruments	TCL-SCL mixed	***3X50 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**
	Participatory Activity*						
	Project Results/ Case Study Results/ PBL Results*						
	Cognitive						
	Assignment	**10**		√	√	√	√
	Quiz	**10**		√	√	√	√
	Midterm Exam	**40**		√	√		
	Final Exam	**40**				√	√
	Total	**100**					
	*) 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;

1. Anonim, 2010, Evaluation of measurement data: Guide to the expression of uncertainty in measurement, BPIM .
2. Drijarkara, A.P. dan Zaid, G. 2005, Metrologi: Sebuah Pengantar, Puslit KIM-LIPI .
3. Hebra, A.J., 2010, The Physics of Metrology, Springer-Verlag, Morlenbach, Germany .
4. Janne Kivilaakso, J., Pitkäkoski, A., Valli, J., Johnson, M., Inamoto, N., Aukia, A., dan Saito, M., 2006, Calibration Book, Vaisala Oyj, Helsinki Finland .
5. Leach, R.K., 2010, Fundamental Principles of Engineering Nanometrology, Elsevier Inc., Burlington.

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<tr><td>Lecturers (Team Teaching)</td><td colspan="4">1. Prof. Dr. Eng. Kuwat Triyana, M.Si</td></tr>
<tr><td rowspan="2">Authorization</td><td>Date of Drafting</td><td>Lecturer Coordinator</td><td>Head of Curriculum Committee</td><td>Head of Study Program</td></tr>
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