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

Photoacoustic and Photothermal

MFF5434 / 2 Credits

Lecturer Coordinator:

Dr. Mitrayana, S.Si., M.Si.

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
MFF5434	*Photoacoustic and Photothermal*	*2*	*Even*	*Elective*	*None*

Short Description

Photoacoustic and Photothermal 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:
Fourier transform photoacoustic spectroscopy of solids; Photoacoustic Detection of Light Shifts in Molecules; Step-and-Integration of Interferometry in Mid-Infrared with Photothermal Beam Deflection and Microphone Detection of Gas Samples; Photothermal Electrostatics of the Pd-PVDF Photoproelectric Hydrogen Gas Sensor; Photoacoustic Spectrum of Chlorinated Ethylene at CO2 Laser Frequency; Photothermal Deflection Technique (TDF): Fast Tracking Gas Detection in the Atmosphere; Measurement of Photoacoustic Gradient/Vertical Change of Ammonia in the Atmosphere; Photoacoustic and Photothermal Engineering Interfaces for Methodology and Instrumentation for Agricultural, Environmental and Medical Applications; In Situ Monitoring of Photoacoustic Gas Tracking in Rural Environments; Methane Photoacoustic Field Measurement; Liquid Nitrogen Cooling CO Laser in Photoacoustic Setting For Low Gas Concentration Monitoring; Photothermal Detection of Tracking Chemicals by Fiber Optic Interferometry Probe; Fiber Optic Laser Photoacoustic Spectroscopy for Detection of Organic Pollutants in Solution.

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.

Course Outcomes (CO)	**Upon completion of this course, students should be able to:**	
	CO1	Understand the concepts and solve cases related to photoacoustic and photothermal phenomena.
	CO2	Understand the working principle of supporting equipment and design experimental set-ups for photoacoustic and photothermal systems.
	CO3	Understand the group's work in studying the development of photoacoustic and photothermal Theory and Applications.
	CO4	
	CO5	
	CO6	
	CO7	
	CO8	

The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1	Photoacoustic Spectroscopy , fourier transformations	Discussion, presentation	2 x 50 minutes
	CO1	Photoacoustic Detection of Light Shifts in Molecules.	Discussion, presentation	2 x 50 minutes
	CO1	Step-and-Integration of Interferometry in the Mid-Infrared with Photothermal Beam Deflection and Microphone Detection of Gas Samples.	Discussion, presentation	2 x 50 minutes
	CO2	Photothermal Electrostatics of the Photopro Electric On-PVD Hydrogen Gas Sensor.	Discussion, presentation	2 x 50 minutes
	CO2	Photoacoustic Spectrum of Chlorinated Ethylene at CO2 Laser Frequency.	Discussion, presentation	2 x 50 minutes
	CO2	Photothermal Deflection Technique (TDF).	Discussion, presentation	2 x 50 minutes
	CO2	Fast Tracking Gas Detection in the Atmosphere.	Discussion, presentation	2 x 50 minutes
	CO3	Measurement of Photoacoustic Gradient/Vertical Ammonia Changes in the Atmosphere.	Discussion, presentation	2 x 50 minutes
	CO3	Photoacoustic and Photothermal Engineering Interfacing for Methodology and Instrumentation with new hyphens Suitable for	Discussion, presentation	2 x 50 minutes

		Agricultural, Environmental and Medical Applications.		
	CO3	In Situ Monitoring of Photoacoustic Gas Tracking in Rural Environments.	Discussion, presentation	2 x 50 minutes
	CO4	Methane Photoacoustic Field Measurement.	Discussion, presentation	2 x 50 minutes
	CO4	Liquid Nitrogen Cooled CO Laser in Photoacoustic Set-Up For Low Gas Concentration Monitoring.	Discussion, presentation	2 x 50 minutes
	CO4	Photothermal Detection of Tracking Chemicals by Fiber Optic Interferometry Probe.	Discussion, presentation	2 x 50 minutes
	CO4	Fiber Optic Laser Photoacoustic Spectroscopy for Detection of Organic Pollutants in Solutions.	Discussion, presentation	2 x 50 minutes
	Final Exam/ Project Task Results/ Case Analysis Results			
Learning Methods	Discussion, presentation			
Student Learning Experience	Learn to analyze and review: Photoacoustic Spectroscopy , fourier transformations, Photoacoustic Detection of Light Shifts in Molecules., Step-and-Integration of Interferometry in the Mid-Infrared with Photothermal Beam Deflection and Microphone Detection of Gas Samples., Photothermal Electrostatics of the Photopro Electric On-PVD Hydrogen Gas Sensor., Photoacoustic Spectrum of Chlorinated Ethylene at CO2 Laser Frequency., Photothermal Deflection Technique (TDF)., Fast Tracking Gas Detection in the Atmosphere., Measurement of Photoacoustic Gradient/Vertical Ammonia Changes in the Atmosphere., Photoacoustic and Photothermal Engineering Interfacing for Methodology and Instrumentation with new hyphens Suitable for Agricultural, Environmental and Medical Applications., In Situ Monitoring of Photoacoustic Gas Tracking in Rural Environments., Methane Photoacoustic Field Measurement., Liquid Nitrogen Cooled CO Laser in Photoacoustic Set-Up For Low Gas Concentration Monitoring., Photothermal Detection of Tracking Chemicals by Fiber Optic Interferometry Probe., Fiber Optic Laser Photoacoustic Spectroscopy for Detection of Organic Pollutants in Solutions..			
Access to Learning Media/ LMS and Offline and Online Percentage	Google meet and 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	30%		7,5%	7,5%	7,5%	7,5%
Quiz						
Midterm Exam	35%		17,5%	17,5%		

	Final Exam	35%				17,5%	17,5%
	*) 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. Photoacoustic and Photothermal Phenomena, Proceedings of the 5th International Topical Meeting, Heidelberg, Fed. Rep. of Germany, July 27–30, 1987. Editors: Peter Hess and Josef Pelzl (Springer Series in Optical Sciences). 2. Photoacoustic and Photothermal Phenomena III, Proceedings of the 7thInternational Topical Meeting, Doorwerth, The Netherlands, August 26–30, 1991. Editors: Bicanic, Dane (Ed.) (Springer Series in Optical Sciences).
Lecturers (*Team Teaching*)	1. Dr. Mitrayana, S.Si., M.Si. 2. Dr. Moh. Ali Joko Wasono, M.S. 3. 4.

Authorization	**Date of Drafting**	**Lecturer Coordinator**	**Head of Curriculum Committee**	**Head of Study Program**
		Dr. Mitrayana, S.Si., M.Si.	Dr.Ing. Ari Setiawan	Mirza Satriawan, M.Si., Ph.D