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

Material Characterisation Methods

MFF5814 / 3 Credits

Lecturer Coordinator:

Dr. Chotimah, 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
MFF5814	*Material Characterisation Methods*	*3*	*Even*	*Elective*	*None*

Short Description

Material Characterisation Methods course is Elective course 3 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 to material methods and analysis; molecular spectrometry: UV-visNIR, Raman, Nuclear Magnetic Resonance (NMR), mass spectroscopy (MS); atomic spectroscopy: Atomic Absorption Spectrometry (AAS) and Atomic Fluorescence Spectrometry (AFS), instruments such as Gas Chromatography (GC), High-Performance Liquid Chromatography (HPLC), Electrophoresis; image instruments: Optical Microscopy, Confocal Microscopy, Electron Microscopy (Scanning Electron Microscopy or SEM, Transmission Electron Microscopy or TEM, Scanning Probe Microscopy or SPM, Scanning Tunnelling Microscopy (STM), Atomic Force Microscopy (AFM), electrochemical instruments: Potentiometry, Voltammetry, Conductimetry; Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), X-ray Diffraction (XRD), Angle-resolved photoemission spectroscopy (ARPES), X-ray Photoemission spectroscopy (XPS), Vibrating-sample magnetometer (VSM).

The courses are held in class for 14 weeks, each week's session last for 3 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 1	Have a commendable attitude and ethics as a scientist.
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	Determine the types of characters in the research material and the research process's result.
	CO2	Choose the method needed to find out in detail information about the character of a material.
	CO3	Anticipate the condition of the material whose properties will be known.
	CO4	Analyze the results shown by the characterization support tool.
	CO5	
	CO6	
	CO7	
	CO8	

The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1	Introduction: Fundamentals of Spectroscopy, GEM interaction with matter, Uv-Vis Spectroscopy.	Lecture	3 x 50 minutes
	CO1	UV-Vis spectroscopy, and calculate the Energy Gap from the UV-Vis curve. Assignment review paper using UV-Vis characterization.	Lecture	3 x 50 minutes
	CO1	FT-IR Spectroscopy, Raman Spectroscopy.	Lecture	3 x 50 minutes
	CO2	Atomic Absorption Spectrometry (AAS) and Atomic Fluorescence Spectrometry (AFS). Review paper assignment using FT IR, Raman, AAS and AFS characterization (group).	Lecture	3 x 50 minutes
	CO2	Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC), mass spectroscopy (MS).	Lecture	3 x 50 minutes
	CO2	Nuclear Magnetic Resonance (NMR), Group assignment presentation.	Lecture	3 x 50 minutes
	CO2	Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC).	Lecture	3 x 50 minutes
	CO3	Optical Microscopy, Confocal Microscopy.	Lecture	3 x 50 minutes

	CO3	Scanning Electron Microscopy or SEM, Transmission Electron Microscopy or TEM.	Lecture	3 x 50 minutes
	CO3	Scanning Probe Microscopy or SPM, Scanning Tunnelling Microscopy or STM, Atomic Force Microscopy (AFM).	Lecture	3 x 50 minutes
	CO4	Electrochemical instruments: Potentiometry, Voltammetry, Conductimetry.	Lecture	3 x 50 minutes
	CO4	X-ray Diffraction (XRD).	Lecture	3 x 50 minutes
	CO4	Electronic Impedance Analyzer	Lecture	3 x 50 minutes
	CO4	Exposure to student assignments (group and independent).	Lecture	3 x 50 minutes
	Final Exam/ Project Task Results/ Case Analysis Results			
Learning Methods	Lecture			
Student Learning Experience	Learn to analyze and review: Introduction: Fundamentals of Spectroscopy, GEM interaction with matter, Uv-Vis Spectroscopy., UV-Vis spectroscopy, and calculate the Energy Gap from the UV-Vis curve. Assignment review paper using UV-Vis characterization., FT-IR Spectroscopy, Raman Spectroscopy., Atomic Absorption Spectrometry (AAS) and Atomic Fluorescence Spectrometry (AFS). Review paper assignment using FT IR, Raman, AAS and AFS characterization (group)., Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC), mass spectroscopy (MS)., Nuclear Magnetic Resonance (NMR), Group assignment presentation., Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC)., Optical Microscopy, Confocal Microscopy., Scanning Electron Microscopy or SEM, Transmission Electron Microscopy or TEM., Scanning Probe Microscopy or SPM, Scanning Tunnelling Microscopy or STM, Atomic Force Microscopy (AFM)., Electrochemical instruments: Potentiometry, Voltammetry, Conductimetry., X-ray Diffraction (XRD)., Electronic Impedance Analyzer, Exposure to student assignments (group and independent)..			
Access to Learning Media/ LMS and Offline and Online Percentage	Sync (google meet), Asynchronous (Simaster and WAG)			

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. McMohan, G., 2007: Analytical Instrumentation: A Guide to Laboratory, Portable and Miniaturized Instruments, John Wiley & Sons Ltd, England. 2. Skoog, D.A. dan West, D.M., 1980: Principles of Instrumental Analysis,Sounders College, Philadelphia.
Lecturers (*Team Teaching*)	1. Dr. Chotimah, M.Si. 2. Prof. Dr. Harsojo, Drs., S.U., M.Sc. 3. 4.

Authorization	**Date of Drafting**	**Lecturer Coordinator**	**Head of Curriculum Committee**	**Head of Study Program**
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