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



Condensed Matter Optics MFF5780 / 3 Credits

Lecturer Coordinator:

Moh. Adhib Ulil Absor, S.Si., M.Sc., Ph.D.

UNIVERSITAS GADJAH MADA FACULTY OF MATHEMATICS AND NATURAL SCIENCE 2022

SEMESTER LEARNING ACTIVITY PLANS (SLAP)CodeCourse NameCredits (credits)SemesterStatusPrerequisiteMFF5780Condensed3EvenElectiveNoneMFF5780Condensed3EvenElectiveNoneMatter Optics01111Short DescriptionCondensed Matter Optics course is Elective course 3 credits (Theory) in the 2022 Curriculum Mass Physics Study Program, Faculty of Mathematics and Natural Science UGM.The syllabus of this course is as follows: Use between the state of the base state of the state of the base state of the base state of the state of the base state of the base state of the state of the base state of the base state of the state of the base state of the state of the base state of the base state of the state of the base state of the base state of the state of t		Universitas Gadjah Mada Faculty of Mathematics and Natural Science Physics Department / Study Program Master Physics Semester Even 2022/2023							
CodeCourse NameCredits (credits)SemesterStatusPrerequisiteMFF5780Condensed3EvenElectiveNoneMatter Optics01111Short DescriptionCondensed Matter Optics course is Elective course 3 credits (Theory) in the 2022 Curriculum Mass Physics Study Program, Faculty of Mathematics and Natural Science UGM.10The syllabus of this course is as follows: Use between the time of the base is as follows:11	SEMESTER LEARNING ACTIVITY PLANS (SLAP)								
MFF5780 Condensed Matter 3 Even Elective None Matter Optics Image: Short Condensed Matter Optics course is Elective course 3 credits (Theory) in the 2022 Curriculum Mass Physics Study Program, Faculty of Mathematics and Natural Science UGM. The syllabus of this course is as follows: Image: Short is a start of the level of the	Code	Course Name	Course NameCredits (credits)Semester			Prerequisite			
Short DescriptionCondensed Matter Optics course is Elective course 3 credits (Theory) in the 2022 Curriculum Mas Physics Study Program, Faculty of Mathematics and Natural Science UGM.The syllabus of this course is as follows:	<i>MFF5780</i>	Condensed Matter Optics	l 3 Even Elective None						
Introduction of fundamental optical properties of materials: the theory of propagation of electromagned waves in materials, optical constants, refractive indices, dispersions. Basic optical studies for conduct materials, insulators, and semiconductors. The optical properties of several compressed materials: photo crystals, surface plasmons, metamaterials, spintronic materials, organic semiconductors, magneto-opti- thin films, and exciton. Nonlinear optical properties of the material are compressed. The courses are held in class for 14 weeks, each week's session last for 3 x 50 minutes. Four weeks 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 1 minutes. The formative evaluation is implemented as individual assignments for each student in the fo of completing an assignment individually. Monitoring is carried out by observing student activities dur the course, such as attendance, Q&A and discussion about the material presented, and student performat in completing individual assignments.	Short Description Program	Condensed Matter Optics 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 of fundamental optical properties of materials: the theory of propagation of electromagnetic waves in materials, optical constants, refractive indices, dispersions. Basic optical studies for conductor materials, insulators, and semiconductors. The optical properties of several compressed materials: photonic crystals, surface plasmons, metamaterials, spintronic materials, organic semiconductors, magneto-optics, thin films, and exciton. Nonlinear optical properties of the material are compressed. 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.							
Learning Outcomes (PLO) 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 3 PLO 3 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. 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	Learning Outcomes (PLO) Imposed on the Course	PLO 3 PLO 4 PLO 6	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 3 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 4 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	<i>CO1</i>	Formulate and describe the physical phenomena being studied and reveal vital					
Outcomes	001	information in the physics problem through various tricks or specific					
(\mathbf{CO})		mathematical procedures and utilizing different approximations.					
(00)	C02	Pay attention to physics problems in detail analyze issues and build arguments					
	002	logically and carefully					
	<i>C</i> 02	Descent and calciumly. Research physics problems from various sources and references to understand important					
	005	information.					
	<u> </u>	Solve issues with structured solutions (well-defined solutions) formulate a problem					
	004	carefully, and try other approaches to improve the solution of a challenging problem.					
	CO5	eactany, and ay other approaches to improve the solution of a chancinging problem.					
	C06						
	C07						
	C08						
The	000	Learning Materials Learning Methods Tim					
Correlation of		Learning Waterians	Learning Methods	Allocation			
CO to				Anocation			
Learning	<u> </u>	Inter leading a lead first in the	T e eterne	2 - 50			
Materials and	01	Introduction: classification of	Lecture	3 X 50			
Methods and		optical processes, optical		minutes			
Time		coefficients, refractive index and					
Allocation		dielectric constant, optical					
Anocation		materials, optical characteristics in					
		solids, and microscopic models.	• • •	2 50			
	COI	Classical propagation (Part I):	Lecture	3 x 50			
		propagation of light in a medium,		minutes			
		the dipole oscillator model, and					
		Dispersion.	~				
	COI	Classical propagation (Part II):	Lecture	3 x 50			
		propagation of light in a medium,		minutes			
		the dipole oscillator model, and					
		Dispersion.	·	2 50			
	<i>CO2</i>	Interband absorption part I:	Lecture	3 x 50			
		interband transition, rate of direct		minutes			
		absorption transition, absorption in					
		direct semiconductor, indirect					
		semiconductor absorption,					
		interband absorption, absorption					
		spectrum measurement, and					
		semiconductor photodetector.	-				
	<i>CO2</i>	Interband absorption part II:	Lecture	3 x 50			
		interband transition, Direct		minutes			
		absorption transition rate,					
		absorption in direct semiconductor,					
		indirect semiconductor absorption,					
		interband absorption, absorption					
		spectrum measurement, and					
		semiconductor photodetector.					
	<i>CO2</i>	Exciton: basic concept, free	Lecture	3 x 50			
		exciton, Frenkel exciton.		minutes			
	CO2	Luminescence: Emission of light in	Lecture	3 x 50			
		solids, interpita luminescence,		minutes			

	photoluminescence, and						
	electroluminescence.						
	СО3	Semiconductor quantum well (Part	Lecture	3 x 50			
		I): quantum confined structure,		minutes			
		Energy level, Optical absorption					
		and exciton, stark effect.					
	CO3	Semiconductor quantum well (Part	Lecture	3 x 50			
		II): quantum confined structure,		minutes			
		Energy level, Optical absorption					
	<i>CO2</i>	and exciton, stark effect.		2 50			
	<i>CO3</i>	Free electrons (Part I): Plasma	Lecture	3 x 50			
		reflectivity, Free carrier		minutes			
		conductivity, Drude models in					
		metals, interplia transitions in					
		Plasmons					
	<u>CO4</u>	Free electrons (Part II): Plasma	Lecture	3 x 50			
	004	reflectivity Free carrier	Lecture	minutes			
		conductivity. Drude models in		mmates			
		metals. Interpita transitions in					
		metals, Doped semiconductors, and					
		Plasmons.					
	<i>CO4</i>	Molecular materials: introduction	Lecture	3 x 50			
		of electronic states, molecular		minutes			
		optical spectra, aromatic					
		hydrocarbons, conjugated					
		polymers, optoelectronic organics.					
	<i>CO4</i>	Phonons: Active infrared phonons,	Lecture	3 x 50			
		Reflectivity and absorption		minutes			
		infrared, Polariton, Polaron,					
	<u> </u>	inelastic scattering of light.	, , , , , , , , , , , , , , , , , , ,	2 50			
	<i>CO4</i>	Nonlinear optics: susceptibility	Lecture	3 x 50			
		tensor non-linear, second-order		minutes			
		offocts					
		Final Fyam/ Project Task Result	ts/ Case Analysis Results				
Loorning	Lecture	That Example Toject Tusk Result	is Cuse marysis Results				
Methods	Liciuie						
Student	Learn to analyz	ze and review: Introduction: classification	of optical processes, optical coe	fficients.			
Learning	refractive index	x and dielectric constant, optical materials,	optical characteristics in solids,	and			
Experience	microscopic m	odels., Classical propagation (Part I): propa	agation of light in a medium, the	e dipole			
•	oscillator mode	el, and Dispersion., Classical propagation (l	Part II): propagation of light in a	a medium, the			
	dipole oscillato	or model, and Dispersion., Interband absorp	btion part I: interband transition,	rate of direct			
	absorption tran	orntion spectrum measurement, and semic	anductor photodetector. Interba	on, interband			
	part II: interbar	ad transition. Direct absorption transition ra	ate. absorption in direct semicor	ductor, indirect			
	semiconductor	absorption, interband absorption, absorptio	on spectrum measurement, and s	semiconductor			
	photodetector.,	Exciton: basic concept, free exciton, Frenk	kel exciton., Luminescence: Em	ission of light in			
	solids, interpita luminescence, photoluminescence, and electroluminescence., Semiconductor quantum						
	well (Part I): qu	uantum confined structure, Energy level, O	ptical absorption and exciton, s	tark effect.,			
	Semiconductor quantum well (Part II): quantum confined structure, Energy level, Optical absorption and						

	exciton, stark effect., Free electrons (Part I): Plasma reflectivity, Free carrier conductivity, Drude models								
	in metals, Interpita transitions in metals, Doped semiconductors, and Plasmons., Free electrons (Part II):								
	Plasma reflectivity, Free carrier conductivity, Drude models in metals, Interpita transitions in metals,								
	Doped semiconductors, and Plasmons., Molecular materials: introduction of electronic states, molecular								
	optical spectra, aromatic hydrocarbons, conjugated polymers, optoelectronic organics., Phonons: Active								
	Nonlinear optics: susceptibility tensor non-linear, second-order nonlinear, third-order non-linear effects								
Access to	Sync (google meet), Asynchronous (google classroom, video)								
Learning									
Media/ LMS									
and Offline									
and Online									
Percentage									
Assessment									
Methods and	Assessment		Assessment	Criteri	a/In				
Synchronizati	Methods		Percentage	dicator	'S	CO1	CO1 CO2		CO4
on with CO	Participator	X 7							
	Activity*	y							
	Project Resu	ilts/							
	Case Study								
	Results/ PBI								
	Results*								
	Cognitive								
	Assignment		30%			7,5%	7,5%	7,5%	7,5%
	Quiz 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:								
References	1. Jai Singh. 2	006. Or	tical Properties	s of Cond	lensed	l Matter ar	nd Applica	tions.John	Wiley &
	Sons, Chichest	ter, Eng	land, UK.						
	2. Joseph H Si	mmons	, Kelly S Potter	; 2000, C	Optica	l Materials	s, Academ	icPress, Sa	an Diego,
	USA.		-		-				-
	3. Yoshinobu A	Aoyagi,	Kotaro Kajika	wa (edito	ors), 2	013, Optic	cal Propert	ies ofAdva	anced
	Materials, Spri	inger-V	erlag Berlin, H	eidelberg	ς.				
	4. Mark Fox, 2001, Optical Properties of Solids, Oxford University Press, Oxford, UK.							UK.	
Locturers	1 Moh Adhib		nsor S Si M Sc	Ph D					
(Team	2.	J UIII AU		., 1 11.D.					
(Ieum Teaching)	3.								
1 caching)	4.								
Authorization	Date of	Lec	turer Coordin	ator	Hea	ad of Cur	riculum	Hea	d of Study
	Drafting	Lu		ator		Commit	tee	P	rogram
								Mirzo	triowon M.C.
		Mal	h Adhih III;1 A	hear	D#	Ing Arie	ationson		Ph D
		S	.Si., M.Sc., Ph	D.					