SEMESTER LEARNING ACTIVITY PLANS (SLAP)

SEMESTER ODD 2022/2023

Physics Undergraduate Study Program

Physics Department

Modern Optics

MFF 3411/ 2 Credits

Lecturer Coordinator:

Dr. Iman Santoso
Dr. Mitrayana

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 3411	*Modern Optics*	*T: 2*	*P: …*	*ODD*	*Compulsory*	*Wave (MFF1405), Quantum Physics I (MFF2034)*

Short Description	The Modern Optics course is a mandatory two credits course in the 2021 Curriculum for the Undergraduate Physics Study Program, FMIPA UGM. The general objective of holding this Constitutional Court is to provide students with mastery of fundamental concepts regarding optical phenomena and optical systems, including lenses and mirrors (geometric optics). Furthermore, the concepts of physical optics include interference, diffraction, polarization, optical spectrum, and lasers. So that this Constitutional Court is related to competence in the Knowledge aspect (PLO 2) and aspects of Long life learning/self-development (PLO 5). Learning is carried out based on a face-to-face schedule in class for 14 weeks, with each meeting held for 100 minutes each week. Four weeks during the lecture period are used for Mid-Semester Examinations and Final Semester Examinations, each of which is held on a scheduled basis for two weeks by the Academic Section of FMIPA UGM. Evaluation for students for course assessment is carried out summatively and formatively. This is manifested in the form of written exams, both the Mid-Semester Examination and the Final Semester Examination, which take a maximum of 120 minutes. The formative evaluation is realized through independent assignments for each student. The form of independent activity is the completion of a task given to students to be discussed in groups and then completed independently at home in the form of a written report for each task. The monitoring process is carried out by looking at student activities during the lecture, such as attendance at lectures, questions and answers and discussion of the material being presented, and student performance in carrying out independent assignments in the form of homework given.

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	Students can explain and solve cases in geometric optics.
	CO2	Students can explain and solve cases in physical optics.

		Learning Materials	Learning Methods	Time Allocation
The Correlation of CO to Learning Materials and Methods, and Time Allocation	***CO 1 , CO 2***	INTRODUCTION: History of the Development of Optics, Electromagnetic Fields.	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	Review material from Mathematical Physics: Vector Algebra (inner product, cross product, integral divergence theorem, Stokes integral theorem, divergence, rotation, complex	TCL-SCL Mixed	***2X50 minutes***

		algebra, Euler notation, Phasor, differential wave equations.		
	CO 1 , CO 2	BASICS OF GEOMETRY OPTICS: Introduction, Branches of Optics, The Nature of Light, Light Rays (B.C), Reflection and Refraction (Snell's Law), Total Internal Reflection, Characteristics of a Clear Medium, Minimum Deviation, Minimum Deviation and Type of Material, Light Dispersion, Refraction In Plan-Parallel Glass, Huygens' Principle on Reflection and Refraction, Fermat's Principle on Reflection, Fermat's Principle on Refraction, Optical Path Length (PLO).	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	4. FRESNEL EQUATION: Electric Field Perpendicular to the Incident Plane, Electric Field Parallel to the Incident Plane, Interpretation of the Fresnel Equation, Reflectance, and Transmittance.	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	5. GEOMETRY OPTICS (Paraaxial Optical): Spherical Reflector Surface (R.S), Single Spherical Reflector Surface.	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	THIN LENSES: Introduction, Types of Lenses, Geometry, Characteristics, Focal Planes, Shadow Formation Equations, Image Formation, Properties and Magnification of Shadows, Lateral Magnification, Magnification of Three Dimensional Objects, Sign Conventions, Position of Convex Lens Shadows, Three-dimensional Image Orientation, Lens combination.	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	A. THICK LENSES: Geometry, Characteristics, Beam State, Nodal Points and Optical Centers, Light Propagation in Thick Lenses. B. ABERRATION: Introduction, Types of Monochromatic Aberration	TCL-SCL Mixed	***2X50 minutes***
	Midterm exam/Project Task Results/Case Analysis Results			
	CO 1 , CO 2	Wave superposition: Algebraic method, Complex method, Phasor sum, Standing wave, Beats, Group	TCL-SCL Mixed	***2X50 minutes***

		velocity, Fourier analysis, Fourier integral, Pulse and wave packets, Optical bandwidth.		
	CO 1 , CO 2	Polarization of Light: Properties of polarized light, Polarisator, Dichroism, Birefringence, Scattering and polarization, Polarization by reflection, Retardes, Circular Polarization, Light Polarization, Polychromatic, Optical Activity, Optical Modulator, Mathematical description of polarization.	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	Interference: Overview, Interference Terms, Wavefront-splitting Interferometer. Amplitude splitter interferometer, Double-beam dielectric film interference, Multiple-beam interference, Fabry-Perot interferometer, Interferometer application.	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	Diffraction: Preliminary review, Fraunhofer Diffraction, Fresnel Diffraction, Kirchoff's Scalar Diffraction Theory, Limited Wave Diffraction	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	Fourier Optics: Introduction, Fourier Transform, Optical Applications	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	Fundamentals of Coherence Theory: Introduction, Visibility, Common coherence functions and degrees of coherence, Steller's coherence and interferometer, Lasers and Laser light.	TCL-SCL Mixed	***2X50 minutes***
	CO 1 , CO 2	Fundamentals of Coherence Theory: Introduction, Visibility, Common coherence functions and degrees of coherence, Steller's coherence and interferometer, Lasers and Laser light.	TCL-SCL Mixed	***2X50 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	**Learn to examine and study the study of optics from the era of classical physics to modern physics**			

<table>
<tr><td>Access to Learning Media/ LMS and Offline and Online Percentage</td><td colspan="5">Offline (LCD, PPT Slide, Whiteboard, Laptop) and Online (Zoom Meeting, Google Meet, Google Classroom)</td></tr>
<tr><td rowspan="8">Assessment Methods and Synchronization with CO</td><td>Assessment Methods</td><td>Assessment Percentage</td><td>Criteria/ Indicators</td><td>CO1</td><td>CO2</td></tr>
<tr><td>Participatory Activity*</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Project Results/ Case Study Results/ PBL Results*</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Cognitive</td></tr>
<tr><td>Midterm Exam</td><td>50</td><td></td><td>√</td><td></td></tr>
<tr><td>Final Exam</td><td>50</td><td></td><td></td><td>√</td></tr>
<tr><td>Total</td><td>100</td><td></td><td></td><td></td></tr>
<tr><td colspan="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%.</td></tr>
<tr><td>References</td><td colspan="5">Main References;
1. Eugene Hecht (and Alfred Zajac), Optics, fourth (fifth) ed., Addison-Wesley.California, 2001..
2. Peatross and Ware, Physics of light and optics, Brighram Young University, 2013..
3. M.P. Vaughan, Lecture Notes on Optics PY3101, University College Cork, 2014.</td></tr>
<tr><td>Lecturers (Team Teaching)</td><td colspan="5">1. Dr. Iman Santoso
2. Dr. Mitrayana</td></tr>
<tr><td rowspan="2">Authorization</td><td>Date of Drafting</td><td colspan="2">Lecturer Coordinator</td><td>Head of Curriculum Committee</td><td>Head of Study Program</td></tr>
<tr><td></td><td colspan="2">Dr. Iman Santoso</td><td></td><td>Dr. Eng. Ahmad Kusumaatmaja, S.Si., M.Sc.</td></tr>
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