SEMESTER LEARNING ACTIVITY PLANS (SLAP)

SEMESTER ODD 2022/2023

Physics Undergraduate Study Program

Physics Department

Mathematical and Theoretical Physics I

MFF 2029/ 2 Credits

Lecturer Coordinator:

Dr.rer.nat. Muhammad Farchani Rosyid, 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 2029	*Mathematical and Theoretical Physics I*	*T: 2*	*P: …*	*ODD*	*Elective*	*None*

Short Description	There are three subjects in this lecture: group theory, linear algebra, and functional Analysis. The detailed descriptions of the topics discussed are as follows: Group Theory: semigroups, groups, subgroups, homomorphisms, kernels, co-sets, factor groups, direct products, group action, types of action, orbits, rigidity, rink, sub-rink, field, Linear Algebra: vector spaces, vector subspaces, linear independence and dependence, bases, linear mapping, isomorphism, matrix representation for vector spaces and linear mapping, systems of linear equations, and self-valued equations. Functional Analysis: metric spaces, open and closed spheres, metric topologies, long spaces, scalar product spaces, Hilbert spaces, orthogonalities, Gramm-Schmidt orthonormalization, Pythagorean theorems, Schwartz inequalities, orthonormal bases, Fourier series, operators in Hilbert spaces, companion operators, self-accompanied operators, isometric mapping, self-assessment problems for operators in Hilbert spaces.	
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 3	General Skills. Able to communicate the results of problem studies and physical behavior both in writing and verbally, as well as being able to lead and collaborate at various levels of roles in a team.
	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	Mastering and applying the concepts and properties of semigroups, groups, subgroups, homomorphisms, kernels, co-sets, factor groups, direct products, group actions, types of action, orbits, and rigid points.
	CO2	Mastering and applying the concepts and properties of arenas, sub-fields, fields, vector spaces, vector subspaces, freedom, linear coherence, bases,
	CO3	Mastering the concepts and properties of linear mapping, isomorphism, matrix representation for vector spaces and linear mapping, systems of linear equations, and self-value equations.
	CO4	Mastering and applying the concepts and properties of metric spaces, open and closed spheres, metric topology, long spaces, scalar product spaces, Hilbert spaces,

		orthogonality, Gramm-Schmidt orthonormalization, Pythagorean theorem, Schwartz inequality, orthonormal basis, Fourier series		
	CO5	Mastering and applying the concepts and properties of operators in Hilbert spaces, companion operators, self-accompanied operators, isometric mapping, and self-assessment problems for operators in Hilbert spaces		
The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO 1	Concepts and properties of semigroups, groups, subgroups, examples	TCL-SCL mixed	***2X50 minutes***
	CO 1	Concepts and properties of group homomorphisms, kernels, co-sets, factor groups, direct products, examples	TCL-SCL mixed	***2X50 minutes***
	CO 1	Concept and properties of group action, types of action, orbits, rigid points, examples	TCL-SCL mixed	***2X50 minutes***
	CO 2	The concept and properties of the arena, sub-rink, field, and examples	TCL-SCL mixed	***2X50 minutes***
	CO 2	Concepts and properties of vector spaces, vector subspaces, linear independence, dependence, bases, examples	TCL-SCL mixed	***2X50 minutes***
	CO 3	Concept and properties of linear mapping, isomorphism, matrix representation for vector spaces and linear mapping, examples	TCL-SCL mixed	***2X50 minutes***
	CO 3	Systems of linear equations, self-valued equations, examples	TCL-SCL mixed	***2X50 minutes***
	Midterm exam/Project Task Results/Case Analysis Results			
	CO 4	Concepts and properties of metric spaces, open and closed spheres, examples	TCL-SCL mixed	***2X50 minutes***
	CO 4	Topological concepts and properties of metrics, long spaces, examples	TCL-SCL mixed	***2X50 minutes***
	CO 4	The concept and properties of scalar product spaces, Hilbert spaces, orthogonality, Gramm-Schmidt orthonormalization, examples	TCL-SCL mixed	***2X50 minutes***
	CO 4	Pythagorean theorem, Schwartz inequalities, orthonormal basis, Fourier series, examples	TCL-SCL mixed	***2X50 minutes***
	CO 5	Concepts and properties of operators in Hilbert space, co-operators, self-accompanied operators, examples	TCL-SCL mixed	***2X50 minutes***
	CO 5	Concept and properties of isometric mapping, the self-value	TCL-SCL mixed	***4X50 minutes***

		problem for operators in Hilbert spaces, examples		
	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	CO5
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. Erwin Kreyszig, 1989, Introductory to Functional Analysis wit Applications, John Wiley & Sons., Inc..
2. M. F. Rosyid, 2015, Aljabar Abstrak dalam Fisika, Gama Press..

Lecturers (*Team Teaching*)

1. Dr.rer.nat. Muhammad Farchani Rosyid, M.Si.

Authorization

Date of Drafting	Lecturer Coordinator	Head of Curriculum Committee	Head of Study Program
	Dr.rer.nat. Muhammad Farchani Rosyid, M.Si.		*Dr. Eng. Ahmad Kusumaatmaja, S.Si., M.Sc.*