SEMESTER LEARNING ACTIVITY PLANS (SLAP)

SEMESTER ODD/EVEN 2022/2023

Physics Undergraduate Study Program

Physics Department

Numerical Method Experiments**)

MFF 2028/ 1 Credits

Lecturer Coordinator:

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UNIVERSITAS GADJAH MADA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
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	Universitas Gadjah Mada Faculty of Mathematics and Natural Science Physics Department / Physics Undergraduate Study Program Semester ODD/EVEN 2022/2023	**Document Number :** ……

SEMESTER LEARNING ACTIVITY PLANS (SLAP)

Code	Course Name	Credits (Credits)		Semester	Status	Prerequisite
MFF 2028	*Numerical Method Experiments**)*	*T: 1*	*P: …*	*ODD/EVEN*	*Compulsory*	*Numerical Method (MFF1024)*

Short Description	The Numerical Method Experiments course is a compulsory subject for the Bachelor of Physics study program at Gadjah Mada University. This course is given in the odd semester of the second year. This course is intended to provide basic knowledge of numerical methods in the form of a practicum that will be used in physics problems. In particular, this course is a prerequisite for taking a more advanced course, namely Computational Physics. Computational Physics is one of the main branching methods related to how physicists describe and research nature other than through the Analytic Theory and Experiment approaches. Through Computing Physics, physicists can accurately predict several macroscopic and microscopic natural phenomena, such as planetary movements, predictions of new materials, and complex calculations involving subatomic particles. Therefore providing essential materials for numerical methods in the early years can provide sufficient provision for undergraduate Physics students to understand problems in computing Physics. Learning is carried out based on a face-to-face schedule in the laboratory or a network (online) for seven weeks, with each week consisting of one meeting for 150 minutes. The first one or two weeks are used to explain the practicum implementation. Evaluation for students for course assessment is carried out summatively and formatively. Summatively it is manifested as an assessment of the Practicum Report manuscript for each practicum module or agenda. The formative evaluation is realized in the assessment or monitoring of the practicum process by the Practicum Assistant for each student.	
Program Learning Outcomes (PLO) Imposed on the Course	***PLO 1***	Attitude. Have faith and fear of God Almighty, and apply good morals, ethics, initiative, and responsibility in completing their duties.
	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 4	Special Skills. Able to design and carry out experiments/theoretical reviews, able to identify a physical problem based on the results of observations and experiments, and able to operate related technologies.
	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 have the ability in Physics Skills, namely how to formulate and describe (to describe) the physical phenomena being studied and reveal important information in

		the physics problem through various tricks or specific mathematical procedures and utilize various approaches (approximations).		
	CO2	Students have the ability in Analytical Skills, namely how to pay attention to physics problems in detail, analyze problems and build arguments logically and carefully.		
	CO3	Students have the ability in Investigative Skills, namely how to search for physics problems from various sources and references to understand important information.		
	CO4	Students have the ability in Problem-Solving Skills, namely how to solve a problem with a structured solution (well-defined solutions), formulate a problem carefully, and try other approaches (approaches) to improve solving a challenging problem (challenging problems).		
The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO 1	Introduction to the Numerical Method Practicum and an explanation regarding the implementation of the practicum	CBL	***1X50 minutes***
	CO 2, CO 3, CO 4	Practical activities for Module 1: Introduction to the latest programming languages that support scientific computing, Python or Julia, and their ecosystems.	CBL	***1X50 minutes***
	CO 2, CO 3, CO 4	Module 2 practicum activities: Utilization of series and recurrence links to evaluate some typical functions.	CBL	***1X50 minutes***
	CO 2, CO 3, CO 4	Practical activities for Module 3: Calculation of root values of any function	CBL	***1X50 minutes***
	Midterm exam/Project Task Results/Case Analysis Results			
	CO 2, CO 3, CO 4	Practical activities Module 4: Calculation of integral values with various forms of integrals and integral limits.	CBL	***1X50 minutes***
	CO 2, CO 3, CO 4	Module 5 practicum activities: Finite difference approach for approximating the derivative value of any function	CBL	***1X50 minutes***
	CO 2, CO 3, CO 4	Practical activity Module 6: Finite difference approach for solving differential equations (Euler method).	CBL	***1X50 minutes***
	CO 2, CO 3, CO 4	Practical activities Module 7: Evaluation of matrices for solving a set of simultaneous equations (Poisson's equations).	CBL	***1X50 minutes***
	CO 1,CO 2, CO 3, CO 4	**Final Test**	CBL	***1X50 minutes***
	Final exams/ Project Task Results/Case Analysis Results			
Learning Methods	**CBL (Case Based Learning): Pretest, Presentation of material and some display material, Hands-on experiments using available set-ups, Making reports**			

<table>
<tr><td>Student Learning Experience</td><td colspan="6">Learn to do practicum activities and practice physics system skills in approximation.</td></tr>
<tr><td>Access to Learning Media/ LMS and Offline and Online Percentage</td><td colspan="6">Offline (Experimental tool) 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><td>CO3</td><td>CO4</td></tr>
<tr><td>Participatory Activity*</td><td></td><td></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><td></td><td></td></tr>
<tr><td colspan="7">Cognitive</td></tr>
<tr><td>Practicum</td><td>70</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Practicum Report</td><td>30</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">*) 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="6">Main References;
1. J. Kiusalaas, 2013, Numerical Methods in Engineering with Python 3, Cambridge University Press, ISBN 978-1-107-03385-6.
2. Curtis F. Gerald dan Patrick O Wheatley, 2004, Applied Numerical Analysis, 7th Eddition, Addison Wesley.
3. A.B. Setio Utomo, 2016, Pengantar Metode Komputasi untuk Sains dan Teknik, UGM Press, ISBN: 978-602-386-091-3.
4. Sholihun dan Zohan Syah Fatomi, 2021, Pemrograman dan Komputasi Numerik Menggunakan Python, UGM Press, ISBN: 978-602-386-957-2.</td></tr>
<tr><td>Lecturers (Team Teaching)</td><td colspan="6">1. Dr. Pekik Nurwantoro
2. Dr. Fahrudin Nugroho
3. Dr. Iman Santoso
4. Dr. Sholihun</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 colspan="2">Head of Study Program</td></tr>
<tr><td></td><td colspan="2">Dr. Pekik Nurwantoro</td><td></td><td colspan="2">Dr. Eng. Ahmad Kusumaatmaja, S.Si., M.Sc.</td></tr>
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