SEMESTER LEARNING ACTIVITY PLANS (SLAP)

SEMESTER EVEN 2022/2023

Physics Undergraduate Study Program

Physics Department

Numerical Method

MFF 1024/ 2 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 EVEN 2022/2023	**Document Number :** ……

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Code	Course Name	Credits (Credits)		Semester	Status	Prerequisite
MFF 1024	*Numerical Method*	*T: 2*	*P: …*	*EVEN*	*Compulsory*	*None*

Short Description	The Numerical Method course is compulsory for the Bachelor of Physics at Gadjah Mada University. This course is given in the even semester of the first year. This course is intended to provide basic knowledge of numerical methods used in physics problems. Moreover, this course is a prerequisite for taking further courses, namely Computational Physics. Computational Physics is one of the main branching methods related to how physicists describe and research nature other than through Analytical Theory and Experimental approaches. Through Computational Physics, physicists can accurately predict several macroscopic and microscopic natural phenomena, such as planetary movements, predictions of new materials, and complex calculations involving sub-atomic particles. Therefore, the provision of basic materials for numerical methods in the early years can provide sufficient provision for S1 Physics students to understand computational physics problems. Learning is carried out based on a face-to-face schedule in class for 14 weeks, with each week consisting of one meeting for 100 minutes, both online and offline. Four weeks during the lecture period are used for the Mid-Semester Examination and the Final Semester Examination , each of which is scheduled for two weeks by the Academic Section of FMIPA UGM. Evaluation for students for course assessment is carried out summatively and formatively. Summatively manifested in the form of written exams, both UTS and UAS, which takes 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 in lectures, questions and answers and discussions on the material being presented, and student performance in doing 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 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 these physics problems through various tricks or specific mathematical procedures and utilize various 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	An introduction to numerical methods, some of the necessary tools, and a brief review of programming languages	TCL-SCL mixed	***2X50 minutes***
	CO 1	Explanation regarding number representation, discretization, and an overview of approximation steps (approach or approximation).	TCL-SCL mixed	***2X50 minutes***
	CO 1	An understanding of the accuracy of numerical calculations and their relation to computer performance.	TCL-SCL mixed	***2X50 minutes***
	CO 4	Explanation of various methods for evaluating function values based on the series method.	TCL-SCL mixed	***2X50 minutes***
	CO 2	Explanation of various methods for evaluating function values based on recurrence links.	TCL-SCL mixed	***2X50 minutes***
	CO 4	The bisection method is the explanation for calculating the zero point or finding the roots of any function without involving the derivative of the function.	TCL-SCL mixed	***2X50 minutes***
	CO 3	Explanation of calculating the zero point or finding the roots of any function by involving the derivative of the function, namely the Newton-Raphson method	TCL-SCL mixed	***2X50 minutes***
	Midterm exam/Project Task Results/Case Analysis Results			
	CO 2	Explanation of the method of calculating integral values in a numerical discretization with various integral forms and integral limits	TCL-SCL mixed	***2X50 minutes***
	CO 3	Explanation of the method of calculating integral values in numerical quadrature with various integral forms and integral limits	TCL-SCL mixed	***2X50 minutes***
	CO 2	Explanation of the matrix evaluation method for solving a set of simultaneous equations	TCL-SCL mixed	***2X50 minutes***
	CO 4	Explanation of the matrix evaluation method for solving eigenvalue problems	TCL-SCL mixed	***2X50 minutes***

	CO 2	Explanation of the finite difference approach for approximating the derivative of any function	TCL-SCL mixed	***2X50 minutes***
	CO 4	Explanation of the finite difference approach for approximating the solution of the differential equation in the initial condition problem	TCL-SCL mixed	***2X50 minutes***
	CO 3	Explanation of the finite difference approach for approximating the solution of the equation	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 examine each topic that is taught.**
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
Participatory Activity*						
Project Results/ Case Study Results/ PBL Results*						
Cognitive						
Assignment	**40**		√		√	
Midterm Exam	**30**			√		√
Final Exam	**30**			√		√
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. 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

Lecturers (*Team Teaching*)	1. Drs. Pekik Nurwantoro, M.S., Ph.D 2. Dr. Fahrudin Nugroho 3. Dr. Iman Santoso 4. Dr. Eko Sulistyo			
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