SEMESTER LEARNING ACTIVITY PLANS (SLAP)

SEMESTER EVEN 2022/2023

Physics Undergraduate Study Program

Physics Department

Simulation and Visualization in Physics

MFF 1528/ 2 Credits

Lecturer Coordinator:

Dr. Eko Sulistya, M.Si

UNIVERSITAS GADJAH MADA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
2022

<table>
<tr><td></td><td colspan="5">Universitas Gadjah Mada
Faculty of Mathematics and Natural Science
Physics Department / Physics Undergraduate Study Program
Semester EVEN 2022/2023</td><td>Document Number :
…………</td></tr>
<tr><td colspan="7">SEMESTER LEARNING ACTIVITY PLANS (SLAP)</td></tr>
<tr><th>Code</th><th>Course Name</th><th colspan="2">Credits (Credits)</th><th>Semester</th><th>Status</th><th>Prerequisite</th></tr>
<tr><td>MFF 1528</td><td>Simulation and Visualization in Physics</td><td>T: 2</td><td>P: …</td><td>EVEN</td><td>Elective</td><td>None</td></tr>
<tr><td>Short Description</td><td colspan="6">This course is an elective course that aims to provide a foundation for graduates of the Physics Study Program to contextualize the learning material they have obtained in Basic Physics I and Basic Physics II courses. In the Simulation and Visualization course in Physics, students are taught to make visualization and simulation of theories received in Basic Physics courses, thereby increasing Coursesan's understanding of the correct concepts and laws of physics, starting from the laws of motion (mechanics course), electricity (Magnetic Electricity), to to the interaction between ions and matter (Modern Physics).
With a strong foundation and motivation to produce various physics visualizations and simulations, we can create computer program products (software) that are very useful for learning facilities in the field of physics and have economic value by marketing them to users who work in the field of education (students). and physics teacher).
This course is an elective course that aims to provide a foundation for graduates of the Physics Study Program to contextualize the learning material they have obtained in Basic Physics I and Basic Physics II courses. In the Simulation and Visualization course in Physics, students are taught to make visualization and simulation of theories received in Basic Physics courses, thereby increasing Coursesan's correct concepts and laws of physics, starting from the laws of motion (mechanics course), electricity (Magnetic Electricity), to to the interaction between ions and matter (Modern Physics).</td></tr>
<tr><td rowspan="3">Program Learning Outcomes (PLO) Imposed on the Course</td><td>PLO 2</td><td colspan="5">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.</td></tr>
<tr><td>PLO 4</td><td colspan="5">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.</td></tr>
<tr><td>PLO 5</td><td colspan="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.</td></tr>
<tr><td rowspan="4">Course Outcomes (CO)</td><td colspan="6">After completing this course, students are expected to be able to:</td></tr>
<tr><td>CO1</td><td colspan="5">Create animation and visualization of 1-dimensional and 2-dimensional object motion to explain the concepts of speed, acceleration and distance traveled by objects.</td></tr>
<tr><td>CO2</td><td colspan="5">Simulate the phenomenon of object motion and relate it to direct measurements, for example the free fall of objects and measure the time it reaches the ground using a stopwatch.</td></tr>
<tr><td>CO3</td><td colspan="5">Using simulation and visualization methods to solve physics problems, and verify the results with the results of manual calculations.</td></tr>
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	CO4	Using software that applies computational methods as a basis for calculating physics simulations, which are related to the application of physics in various fields of people's lives.		
The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO 1	Use Microsoft Excel to create visualizations and physics simulations.	TCL-SCL mixed	***2X50 minutes***
	CO 1	Calculation of physics formulas with VBA (Visual Basic for Application).	TCL-SCL mixed	***2X50 minutes***
	CO 1	Give examples of cases of 2-dimensional motion with the Excel program.	TCL-SCL mixed	***2X50 minutes***
	CO 1	Introducing and using programming languages to create physics simulations and visualizations, including Adobe Flash, Python, and Pygame.	TCL-SCL mixed	***2X50 minutes***
	CO 2	Create class objects with action scripts to visualize with Adobe Flash.	TCL-SCL mixed	***2X50 minutes***
	CO 2	Create motion visualizations with the Interactive physics program	TCL-SCL mixed	***2X50 minutes***
	CO 2	Make an experimental mechanical simulation (2-dimensional motion) by measuring real-time time with a stopwatch.	TCL-SCL mixed	***2X50 minutes***
	Midterm exam/Project Task Results/Case Analysis Results			
	CO 3	Doing physics problems from textbooks by applying physics visualization.	TCL-SCL mixed	***2X50 minutes***
	CO 3	Comparing the results of problem-solving between simulations and analytical calculations	TCL-SCL mixed	***4X50 minutes***
	CO 3	Simulate the interaction between ions and the medium.	TCL-SCL mixed	***4X50 minutes***
	CO 4	Creating a radiotherapy simulation design with the SRIM program.	TCL-SCL mixed	***4X50 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	**When Synchronous: actively discussing material and cases. On Asynchronous/Independent/Structured Assignments: study groups, do quizzes, do assignments.**			

<table>
<tr><td>Access to Learning Media/ LMS and Offline and Online Percentage</td><td colspan="7">Offline (LCD, PPT Slide, Whiteboard, Laptop, unit mikrokontoler) and Online (Zoom Meeting, Google Meet, Google Classroom)</td></tr>
<tr><td rowspan="10">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>10</td><td>Answer questions during class</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>Project Results/ Case Study Results/ PBL Results*</td><td>20</td><td>Problem Solving</td><td></td><td></td><td>√</td><td>√</td></tr>
<tr><td colspan="7">Cognitive</td></tr>
<tr><td>Assignment</td><td>5</td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Quiz</td><td>5</td><td></td><td></td><td></td><td>√</td><td></td></tr>
<tr><td>Midterm Exam</td><td>30</td><td></td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>Final Exam</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="7">Main References;
1. Halliday, D., Resnick, R., & Walker, J. (2018). Fundamentals of physics. 11ed. New York: Wiley..
2. Ziegler, J.F., Biersack, J.P., & Ziegler, M.D., (2008). SRIM The Stopping and Range of Ions in Matter. Chester, Maryland, U.S.A: SRIM Co..
3. Ramtal, D. and Dobre, A., (2011), Physics for Flash Games, Animation, and Simulations, Apress Berkeley, CA.
4. http://www.srim.org/.
5. https://www.design-simulation.com/ip/.

Additional References:
1. Briggs, A., (2012), Hello!Python, Manning Publication Co., Shelter Island, NY.
2. Langtangen, H.P.,(2009), A Primer on Scientific Programming with Python, Springer-Verlag, Berlin
3. Shaw, Z.A., (2011), Learn Python The Hard Way, http://learnpythonthehardway.org/
4. Sulistya, E., (2011), Pemrograman Python-Analisis Data Eksperimen Fisika, Dep. Fisika, FMIPA, UGM</td></tr>
<tr><td>Lecturers (Team Teaching)</td><td colspan="7">1. Dr. Eko Sulistya, M.Si</td></tr>
<tr><td>Authorization</td><td>Date of Drafting</td><td colspan="3">Lecturer Coordinator</td><td>Head of Curriculum Committee</td><td colspan="2">Head of Study Program</td></tr>
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		Dr. Eko Sulistya, M.Si		*Dr. Eng. Ahmad Kusumaatmaja, S.Si., M.Sc.*