SEMESTER LEARNING ACTIVITY PLANS (SLAP)

SEMESTER ODD/EVEN 2022/2023

Physics Undergraduate Study Program

Physics Department

Nuclear Physics Experiments**)

MFF 3204/ 1 Credits

Lecturer Coordinator:

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Eko Tri Sulistyani, M. Sc.

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 ODD/EVEN 2022/2023</td><td colspan="2">Document Number :
…………</td></tr>
<tr><td colspan="8">SEMESTER LEARNING ACTIVITY PLANS (SLAP)</td></tr>
<tr><td>Code</td><td>Course Name</td><td colspan="2">Credits (Credits)</td><td>Semester</td><td>Status</td><td colspan="2">Prerequisite</td></tr>
<tr><td>MFF 3204</td><td>Nuclear Physics Experiments**)</td><td>T: 1</td><td>P: …</td><td>ODD/EVEN</td><td>Compulsory</td><td colspan="2">Nuclear and Particle Physics (MFF2205)</td></tr>
<tr><td>Short Description</td><td colspan="7">The Nuclear Physics Experiments course is compulsory in the 2021 Curriculum of the Physics Undergraduate Study Program, Faculty of Mathematics and Natural Sciences UGM. The general objective of organizing this Courses is to provide mastery of the basic concepts of modern physics and the skills to conduct experiments verifying natural phenomena that appear at the atomic and molecular levels. So that this course is related to competence in the Knowledge and Understanding aspect, aspects of Intellectual Thinking Skills, and Practical Skills aspects. Learning is carried out based on an experimental schedule for five weeks, with each week consisting of a 30-60 minute pretest intended to find out initial understanding regarding the concepts of physics and experimental techniques that will be carried out. The lecturer on the experimental topic carried out the pretest. After that, the related experiment was conducted for 120 minutes in groups (one group consisting of two students) in the Atomic Physics Laboratory of the UGM Physics Department. In the sixth week, a response will be to evaluate students' understanding of physics concepts and related experiments. Evaluation for students for course assessment is carried out summatively and formatively. This manifests in the form of a pretest before students carry out a 30-60 minute dive experiment and a Response Exam after completing all the experimental titles. The response test was carried out for 3 hours containing questions from the five experimental topics and examples of experimental data to be analyzed. The formative evaluation is realized in the form of a Practicum Report for each student for each experimental title that has been carried out. This practicum report was completed independently at home and collected before students took part in the practicum for the title of the following experiment.</td></tr>
<tr><td rowspan="4">Program Learning Outcomes (PLO) Imposed on the Course</td><td>PLO 2</td><td colspan="6">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 3</td><td colspan="6">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.</td></tr>
<tr><td>PLO 4</td><td colspan="6">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="6">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="2">Course Outcomes (CO)</td><td colspan="7">After completing this course, students are expected to be able to:</td></tr>
<tr><td>CO1</td><td colspan="6">Students can carry out nuclear detection using a gas detector (Geiger-Mueller Counter), analyze data, and provide conclusions from this experiment.</td></tr>
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	CO2	Students can carry out alpha spectroscopy experiments to detect alpha particles decaying from radioactive sources using Solid State (NaI Tl) detectors and can analyze data and provide conclusions from this experiment.		
	CO3	Students can conduct beta-ray spectroscopy experiments in terms of detecting beta particles decaying from radioactive sources using a semiconductor (silicon) detector or an organic antransine scintillator detector and can analyze data and provide conclusions from this experiment.		
	CO4	Students can perform alpha-ray spectroscopy experiments in detecting Gamma particles decaying from radioactive sources using Solid State (NaI Tl) detectors. They can analyze data and provide conclusions from this experiment.		
	CO5	Students can perform X-ray spectroscopy experiments to detect discrete X-ray series emitted from radioactive sources using Solid State (NaI Tl) detectors. They can analyze data and provide conclusions from this experiment.		
The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO 1, CO 2, CO 3, CO 4, CO 5	1. Experiment with Nuclear detection methods using GM counters, understand how GM counters work, and determine the absorption of materials against beta and gamma nuclear radiation. 2. Alpha Spectroscopy Experiment, detecting alpha particles decaying from a radioactive source using a Solid State (NaI Tl) detector. 3. Beta Spectroscopy Experiment, detecting beta particles decaying from a radioactive source using a semiconductor (silicon) detector or anthracin organic scintillator detector. 4. Gamma-ray spectroscopy experiment, detecting Gamma particles decaying from a radioactive source using a Solid State (NaI Tl) detector. 5. X-ray spectroscopy experiment, detecting discrete X-ray series emitted from a radioactive source using a Solid State (NaI Tl) detector.	CBL	***4X50 minutes***
	CO 1, CO 2, CO 3, CO 4, CO 5	1. Experiment with Nuclear detection methods using GM counters, understand how GM counters work, and determine the absorption of materials against beta and gamma nuclear radiation. 2. Alpha Spectroscopy	CBL	***3X50 minutes***

		Experiment, detecting alpha particles decaying from a radioactive source using a Solid State (NaI Tl) detector. 3. Beta Spectroscopy Experiment, detecting beta particles decaying from a radioactive source using a semiconductor (silicon) detector or anthracin organic scintillator detector. 4. Gamma-ray spectroscopy experiment, detecting Gamma particles decaying from a radioactive source using a Solid State (NaI Tl) detector. 5. X-ray spectroscopy experiment, detecting discrete X-ray series emitted from a radioactive source using a Solid State (NaI Tl) detector.		
	Midterm exam/Project Task Results/Case Analysis Results			
	CO 1, CO 2, CO 3, CO 4, CO 5	1. Experiment with Nuclear detection methods using GM counters, understand how GM counters work, and determine the absorption of materials against beta and gamma nuclear radiation. 2. Alpha Spectroscopy Experiment, detecting alpha particles decaying from a radioactive source using a Solid State (NaI Tl) detector. 3. Beta Spectroscopy Experiment, detecting beta particles decaying from a radioactive source using a semiconductor (silicon) detector or anthracin organic scintillator detector. 4. Gamma-ray spectroscopy experiment, detecting Gamma particles decaying from a radioactive source using a Solid State (NaI Tl) detector. 5. X-ray spectroscopy experiment, detecting discrete X-ray series emitted from a radioactive source using a Solid State (NaI Tl) detector.	CBL	***1X50 minutes***

	CO 1, CO 2, CO 3, CO 4, CO 5	1. Experiment with Nuclear detection methods using GM counters, understand how GM counters work and determine the absorption of materials against beta and gamma nuclear radiation. 2. Alpha Spectroscopy Experiment, detecting alpha particles decaying from a radioactive source using a Solid State (NaI Tl) detector. 3. Beta Spectroscopy Experiment, detecting beta particles decaying from a radioactive source using a semiconductor (silicon) detector or anthracin organic scintillator detector. 4. Gamma ray spectroscopy experiment, detecting Gamma particles decaying from a radioactive source using a Solid State (NaI Tl) detector. 5. X-ray spectroscopy experiment, detecting discrete X-ray series emitted from a radioactive source using a Solid State (NaI Tl) detector.		***1X50 minutes***
	CO 1, CO 2, CO 3, CO 4, CO 5	"1. Experiment with nuclear detection methods using GM counters, understand how GM counters work, and determine material absorption of beta and gamma nuclear radiation.	CBL	***4X50 minutes***
	CO 1, CO 2, CO 3, CO 4, CO 5	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**			
Student Learning Experience	**Learn to analyze and examine experimental methods**			
Access to Learning Media/ LMS and Offline and Online Percentage	Offline (Experimental tool) and Online (Zoom Meeting, Google Meet, Google Classroom)			

<table>
<tr><td rowspan="9">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><td>CO5</td></tr>
<tr><td>Participatory Activity*</td><td>20</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><td></td></tr>
<tr><td colspan="8">Cognitive</td></tr>
<tr><td>Practicum Report</td><td>40</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Pretest</td><td>10</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Final Test</td><td>30</td><td></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><td></td></tr>
<tr><td colspan="8">*) 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="8">Main References;
1. Melissinos, A. C., 2003: Experiments in Modern Physics, Academic Press.
2. Tim Pengampu, 2016: Petunjuk Praktikum Fisika Inti, Lab. Fisika Atom-Inti.
3. Tsoulfanidis, N., 2015: Measurement and Detection of Radiation, McGraw-Hill..
4. ORTEC AN34 Laboratory Manual, 2020: Experiment in Nuclear Science Laboratory, 4th ed..</td></tr>
<tr><td>Lecturers (Team Teaching)</td><td colspan="8">1. Dr. Iman Santoso
2. Dr.Eng. Fahrudin Nugroho
3. Ikhsan Setiawan, M. Si
4. Eko Tri Sulistyani, M. Sc.</td></tr>
<tr><td rowspan="2">Authorization</td><td colspan="2">Date of Drafting</td><td colspan="2">Lecturer Coordinator</td><td colspan="2">Head of Curriculum Committee</td><td colspan="2">Head of Study Program</td></tr>
<tr><td colspan="2"></td><td colspan="2">Dr. Iman Santoso</td><td colspan="2"></td><td colspan="2">Dr. Eng. Ahmad Kusumaatmaja, S.Si., M.Sc.</td></tr>
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