SEMESTER LEARNING ACTIVITY PLANS
(SLAP)
SEMESTER ODD 2022/2023

Nuclear Physics

MFF5211 / 3 Credits

Lecturer Coordinator:

Dr. Dwi Satya Palupi, S.Si., M.Si.

UNIVERSITAS GADJAH MADA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
2022

Universitas Gadjah Mada
Faculty of Mathematics and Natural Science
Physics Department / Study Program Master Physics
Semester Odd 2022/2023

SEMESTER LEARNING ACTIVITY PLANS (SLAP)

Code	Course Name	Credits (credits)	Semester	Status	Prerequisite
MFF5211	*Nuclear Physics*	*3*	*Odd*	*Elective*	*None*

Short Description

Nuclear Physics course is Elective course 3 credits (Theory) in the 2022 Curriculum Master Physics Study Program, Faculty of Mathematics and Natural Science UGM.

The syllabus of this course is as follows:
1. Core Structure: Petals Model, Nuclear binding energy, and nuclear stability.
2. Decay: Alpha, gamma, beta decay terms, gamma decay classification, beta.
3. Nuclear reaction model: nuclear reaction type, Nuclear reaction energy, partial wave method, reaction cross section, Coulomb and Nuclear scattering, compound reaction, direct reaction, resonant reaction, heavy nuclear reaction.
4. Fission Reaction: fission reaction process, fission reaction characteristics, fission reaction energy, reactions in fission reactors.
5. Neutron reactions: neutron sources, neutron detection, neutron reaction cross-sections, neutron capture, neutron diffraction.
6. Fusion reaction: the process of fusion reactions, characteristics of fusion reactions, fusion reactions in stars.
7. Nuclear reaction applications: Neutron scattering applications, BNCT, combustion in Stars.

The courses are held in class for 14 weeks, each week's session last for 3 x 50 minutes. Four weeks of course period is used for Midterm Exam and Final Exam, each held for two weeks as scheduled.

Student evaluation for course assessments is performed summative and formative. The summative evaluation is implemented as written exams, both Midterm and Final Exam, which take a maximum of 120 minutes. The formative evaluation is implemented as individual assignments for each student in the form of completing an assignment individually. Monitoring is carried out by observing student activities during the course, such as attendance, Q&A and discussion about the material presented, and student performance in completing individual assignments.

Program Learning Outcomes (PLO) Imposed on the Course

PLO 3	Mastering further knowledge of classical and modern physics theory, and its relationship with other disciplines, and has mastered an advanced field of physics specialization that allows him to keep up with the latest international research developments.
PLO 4	Mastering various mathematical disciplines related to an advanced field of physics, and able to develop physical models using various mathematical and computational tools with an inter or multidisciplinary approach to solving problems related to an advanced field of physics.
PLO 6	Able to apply knowledge to analyze, synthesize, formulate problems and solve problems comprehensively in one of advanced field of physics, through experimental or theoretical research, then be able to classify and draw conclusions about their findings for the development of science and technology.

Course Outcomes (CO)	**Upon completion of this course, students should be able to:**	
	CO1	Explain the structure of the nucleus which includes nuclear binding energy and nuclear energy levels. Analyze the stability of a core.
	CO2	State the types of nuclear reactions and their classification. Calculate the reaction energy, the kinetic energy of the nuclei involved in the reaction and the detection method.
	CO3	Students are able to state the types of nuclear reactions (fission and fusion) and their classification.
	CO4	Explain the scattering and reactions of neutrons and their applications.
	CO5	
	CO6	
	CO7	
	CO8	

The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1	Core Structure	Lecture	3 x 50 minutes
	CO1	Core Structure	Lecture	3 x 50 minutes
	CO1	Core decay	Lecture	3 x 50 minutes
	CO2	Core decay	Lecture	3 x 50 minutes
	CO2	Core Reaction	Lecture	3 x 50 minutes
	CO2	Core Reaction	Lecture	3 x 50 minutes
	CO2	Core Reaction	Lecture	3 x 50 minutes
	CO3	Fissi reaction	Lecture	3 x 50 minutes
	CO3	Fissi reaction	Lecture	3 x 50 minutes
	CO3	Fusion Reaction	Lecture	3 x 50 minutes
	CO4	Fusion Reaction	Lecture	3 x 50 minutes
	CO4	Neutron reaction	Lecture	3 x 50 minutes
	CO4	Neutron reaction	Lecture	3 x 50 minutes

	CO4		Lecture	3 x 50 minutes
	Final Exam/ Project Task Results/ Case Analysis Results			
Learning Methods	Lecture			
Student Learning Experience	Learn to analyze and review: Core Structure, Core Structure, Core decay, Core decay, Core Reaction, Core Reaction, Core Reaction, Fissi reaction, Fissi reaction, Fusion Reaction, Fusion Reaction, Neutron reaction, Neutron reaction, .			
Access to Learning Media/ LMS and Offline and Online Percentage	Whiteboard, whiteboard marker, powerpoint slide			

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	30%		7,5%	7,5%	7,5%	7,5%
Quiz						
Midterm Exam	35%		17,5%	17,5%		
Final Exam	35%				17,5%	17,5%

*) 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. K. Krane, 1988, Introductory Nuclear Physics, John Wiley & Sons. 2. J. L. Basdevant.,J. Rich., dan J. Spiro.,2005, Fundamental In Nuclear Physics, Spinger, New York.
Lecturers (*Team Teaching*)	1. Dr. Dwi Satya Palupi, S.Si., M.Si. 2. 3. 4.

Authorization	**Date of Drafting**	**Lecturer Coordinator**	**Head of Curriculum Committee**	**Head of Study Program**
			Dr.Ing. Ari Setiawan	Mirza Satriawan, M.Si., Ph.D

		Dr. Dwi Satya Palupi, S.Si., M.Si.		