SEMESTER LEARNING ACTIVITY PLANS (SLAP)

SEMESTER EVEN 2022/2023

Physics Undergraduate Study Program

Physics Department

Reactor Physics

MFF 3284/ 2 Credits

Lecturer Coordinator:

Dr. Dwi Satya Palupi
Dr. Sholihun
Tim dari PRTA BRIN Yogyakarta

UNIVERSITAS GADJAH MADA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
2022

	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 3284	*Reactor Physics*	*T: 2*	*P: …*	*EVEN*	*Elective*	*Nuclear and Particle Physics I (MFF 2205)*

Short Description	The reactor physics course is an elective course in the Physics Study Program, Department of Physics, FMIPA UGM. The Reactor Physics course aims to provide basic knowledge about power reactors with energy sources derived from fission reactions. This course explains one of the applications of the branches of core and particle physics, mathematical physics, and also modern physics. In this course, students are also invited to conduct online experiments connected to the Kartini Reactor at PSTA Yogyakarta. The contents of the reactor physics course cover the working principles of fission nuclear reactors, core physics theory related to the reactions that occur in fission reactors, the neutron transport equation, which affects the number of fission reactions as well as point reactor kinetics that underlies the dynamics of reactor power. For graduates who work as educators, this basic knowledge of reactor physics can form the basis for knowledge of reactor physics and become a provision when educating their students. As for graduates who work as researchers, this course is expected to be the basis for conducting research in the field of reactor physics and for being able to think critically about energy policy, especially energy related to nuclear in Indonesia. Graduates who work as consultants, bureaucrats, and entrepreneurs, these graduates are expected to be able to use basic reactor knowledge in making decisions, giving advice, and making regulations related to power reactors. These decisions and suggestions can be taken based on the concepts of physics and basic experiments that have been mastered.

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 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	Able to explain the working principle of power reactors, then classify reactor types and explain the advantages and disadvantages of reactor types
	CO2	Able to explain the branches of science that play a role in reactor physics, the core reactions that occur in power reactors, and the effect of these reactions on power reactors.
	CO3	Be able to mention the essential parts and components of the power reactor and their functions.
	CO4	Able to explain the neutron cycle in the reactor core, the processes that occur in the reactor core at critical, sub-critical, and supercritical conditions,
	CO5	Able to explain and solve neutron transport equations in various cases and analyze the relationship between power and the factors that affect changes in power as a function of time.

		Learning Materials	Learning Methods	Time Allocation

The Correlation of CO to Learning Materials and Methods, and Time Allocation	***CO 1***	The basic principles of power reactors with a fission reaction power source: comparison of fission reactors with other power plants, branches of science related to fission reactors, types of fission reactors	TCL-SCL mixed	***2X50 minutes***
	CO 2	The nuclear reactions that occur in the fission reactor core and their effect on reactor power: neutron capture and neutron reactions, fission reactions.	TCL-SCL mixed	***2X50 minutes***
	CO 2	Nuclear reactions that occur in the fission reactor core and their effects on reactor power: alpha, gamma, beta decay, microscopic cross-sections, macroscopic cross-sections, and scattering.	TCL-SCL mixed	***2X50 minutes***
	CO 3	Components of a fission reactor: reactor core, coolant, moderator, NSSS system.	TCL-SCL mixed	***2X50 minutes***
	CO 3	Components of a fission reactor: reactor core, coolant, moderator, NSSS system.	TCL-SCL mixed	***2X50 minutes***
	CO 3	Neutron cycle: formula factor -4, factor 6, reactor size, multiplication factor and its effect on the reactor, critical reactor, subcritical, supercritical	TCL-SCL mixed	***2X50 minutes***
	CO 4	Triga-Mark Reactor Experiment with Kartini Reactor	TCL-SCL mixed	***2X50 minutes***
	Midterm exam/Project Task Results/Case Analysis Results			
	CO4	Triga Reactor Experiment - Mark with Kartini Reactor	TCL-SCL mixed	***2X50 minutes***
	CO 4	Triga - Mark Reactor Experiment with Kartini Reactor	TCL-SCL mixed	***2X50 minutes***
	CO 4	Triga-Mark Reactor Experiment with Kartini Reactor	TCL-SCL mixed	***2X50 minutes***
	CO 4	Triga-Mark Reactor Experiment with Kartini Reactor	TCL-SCL mixed	***2X50 minutes***
	CO 4	Neutron transport equation: factors affecting the neutron flux in the reactor core and its boundary conditions, diffusion approach, and boundary conditions	TCL-SCL mixed	***2X50 minutes***
	CO 5	Solving the neutron diffusion equation in various cases, the balance between fuel and reactor size.	TCL-SCL mixed	***2X50 minutes***
	CO 5	Reactor kinetic equations affect reactor power, hourly equations, and reactor reactivity.	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	**Discussion and work on assignments.**
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	CO5	
Participatory Activity*	**10**	**Attendance**			√	√		
Project Results/ Case Study Results/ PBL Results*	**40**	**Report**			√	√	√	
Cognitive								
Assignment	**10**		√	√	√	√	√	
Midterm Exam	**20**		√	√				
Final Exam	**20**				√	√	√	√
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.J. Duderstat dan L.J. Hamilton, 1976, Nuclear Reactor Analysis, John Wiley & Sons,Inc,New York USA.. 2. website url batan: http://irlkartini.batan.go.id.
Lecturers (*Team Teaching*)	1. Dr. Dwi Satya Palupi 2. Dr. Sholihun 3. Team from PRTA BRIN Yogyakarta 4.

Authorization

Date of Drafting	Lecturer Coordinator	Head of Curriculum Committee	Head of Study Program
	Dr. Dwi Satya Palupi		*Dr. Eng. Ahmad Kusumaatmaja, S.Si., M.Sc.*