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

Image Reconstruction

MFF5878 / 3 Credits

Lecturer Coordinator:

Prof. Drs. Gede Bayu Suparta, M.S., Ph.D.

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 Even 2022/2023

SEMESTER LEARNING ACTIVITY PLANS (SLAP)

Code	Course Name	Credits (credits)	Semester	Status	Prerequisite
MFF5878	*Image Reconstruction*	*3*	*Even*	*Elective*	*None*

Short Description

Image Reconstruction 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:
Introductory mathematics: Fourier analysis, integral operators, general inverse, value decomposition, special functions, Fast Fourier Transforms, integral geometry, Radon transforms, vector fields. Tomography: transmission tomography, emission tomography, diffraction tomography, magnetic resonance imaging, electron tomography, radar, vector tomography, seismic tomography. Stability, sampling, and image resolution. Reconstruction algorithm: filtered back projection, Fourier reconstruction, iterative reconstruction. Linear tomography: pencil beam parallel, linear and curved array fan beam detector, focused fan beam, helical, 3D reconstruction. Special case tomography: loss of orientation, missing data, incomplete data, scanty data tomography, discrete tomography, local tomography. Non-linear tomography: tomography with scattering, optical tomography, impedance tomography, ultrasound tomography.

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 2	Having the professional ability of a scientist.
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 tomography: transmission tomography, emission tomography, tomographic diffraction; magnetic resonance imaging, electron tomography, radar, vector tomography, and seismic tomography.
	CO2	Explain the concepts of Stability: sampling and image resolution; Reconstruction algorithms: filtered back projection, Fourier reconstruction, iterative reconstruction; Linear tomography: pencil beam parallel, fan beam detector linear array, and curve array.
	CO3	Explain focused fan beam, helical, 3D reconstruction; Special case tomography: loss of orientation, missing data, incomplete data; scanty tomography, discrete tomography, local tomography.
	CO4	Explain Non-linear tomography: tomography with scattering; optical tomography, impedance tomography, ultrasound tomography.
	CO5	
	CO6	
	CO7	
	CO8	

The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1			3 x 50 minutes
	CO1			3 x 50 minutes
	CO1			3 x 50 minutes
	CO2			3 x 50 minutes
	CO2			3 x 50 minutes
	CO2			3 x 50 minutes
	CO2			3 x 50 minutes
	CO3			3 x 50 minutes
	CO3			3 x 50 minutes
	CO3			3 x 50 minutes
	CO4			3 x 50 minutes

	CO4			3 x 50 minutes
	CO4			3 x 50 minutes
	CO4			3 x 50 minutes
	Final Exam/ Project Task Results/ Case Analysis Results			
Learning Methods				
Student Learning Experience	Learn to analyze and review: , , , , , , , , , , , , , .			
Access to Learning Media/ LMS and Offline and Online Percentage				

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. Natterer, F. and Wubbeling F., 200.
2. Mathematical Methods in Image Reconstruction, SIAM, USA.
3. Kak, A.C. and Slaney M., 1988, Principles of Computed TomographyImaging, IEEE Press, Piscataway, NJ.
4. Suparta, G.B., 1999, “Focusing Computed Tomography Scanner”, Ph.D.
5. Thesis, Monash university, Merlbourne, Australia.

Lecturers (*Team Teaching*)

1. Prof. Drs. Gede Bayu Suparta, M.S., Ph.D.
2.
3.
4.

Authorization	Date of Drafting	Lecturer Coordinator	Head of Curriculum Committee	Head of Study Program
		Prof. Drs. Gede Bayu Suparta, M.S., Ph.D.	Dr.Ing. Ari Setiawan	Mirza Satriawan, M.Si., Ph.D