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

Advanced Seismology

MFF5930 / 3 Credits

Lecturer Coordinator:

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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
MFF5930	*Advanced Seismology*	*3*	*Even*	*Elective*	*None*

Short Description

Advanced Seismology 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:
Elastic Waves in the Earth: Waves and wave sources: (Wave equations, rheology, boundary terms and initial terms, fundamental settlements, wave sources, scattering effects, seismic wave problems as linear systems Waves in a discrete world: classification of partial differential equations, computational physics, and mesh domains, 1D, 2D, 2.5D, and 3D concepts, the influence of parallel computing on seismology. Introduction to Numerical Methods in Seismology: The Finite-Difference Method, Pseudo-Spectral Method, Finite-Element Method, Spectral-Element Method, Volume-Finite Method, Volume-Finite-Volume Method, The Discontinuous Galerkin Method. III Application: Application in global seismology and geosciences. Some illustrations of seismological problems in computer code. The challenges of today's seismology and geosciences.

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	Conduct statistical studies on earthquake data spatially and temporally.		
	CO2	Conduct physical studies (static stress) in earthquakes events.		
	CO3	Conduct studies (dynamic stress) on earthquake events.		
	CO4	Modeling seismic wave using certain software.		
	CO5	Have ethics and professional attitudes that are commendable as scientists.		
	CO6			
	CO7			
	CO8			
The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1	Review: Earthquake Source Parameter and Mechanism	Lecture, discussion	3 x 50 minutes
	CO1	Earthquake Sources: Introduction to Statistical and Physical Reviews.	Lecture, discussion	3 x 50 minutes
	CO1	Statistical Overview: Introduction to Earthquake Catalogs and Seismicity Parameters.	Lecture, discussion	3 x 50 minutes
	CO2	Statistical Review: Determination of Seismicity Parameters.	Lecture, discussion	3 x 50 minutes
	CO2	Physical Overview: Stress and Earthquake Occurrence.	Lecture, discussion	3 x 50 minutes
	CO2	Physical Overview: Static Stress (Coulomb Stress).	Lecture, discussion	3 x 50 minutes
	CO2	Physical Overview: Static Stress: Software application.	Lecture, discussion	3 x 50 minutes
	CO3	Wave Equation Review	Lecture, discussion	3 x 50 minutes
	CO3	Body wave equation (1)	Lecture, discussion	3 x 50 minutes
	CO3	Body wave equation (2)	Lecture, discussion	3 x 50 minutes
	CO4	Wave propagation in the medium	Lecture, discussion	3 x 50 minutes
	CO4	Wave propagation in a layered medium	Lecture, discussion	3 x 50 minutes
	CO4	Physical Overview: Dynamic Stress	Lecture, discussion	3 x 50 minutes
	CO4	Model of dynamic wave propagation in layered medium with QSEIS software.	Lecture, discussion	3 x 50 minutes
	Final Exam/ Project Task Results/ Case Analysis Results			

Learning Methods	Lecture, discussion
Student Learning Experience	Learn to analyze and review: Review: Earthquake Source Parameter and Mechanism, Earthquake Sources: Introduction to Statistical and Physical Reviews., Statistical Overview: Introduction to Earthquake Catalogs and Seismicity Parameters., Statistical Review: Determination of Seismicity Parameters., Physical Overview: Stress and Earthquake Occurrence., Physical Overview: Static Stress (Coulomb Stress)., Physical Overview: Static Stress: Software application., Wave Equation Review, Body wave equation (1), Body wave equation (2), Wave propagation in the medium, Wave propagation in a layered medium, Physical Overview: Dynamic Stress, Model of dynamic wave propagation in layered medium with QSEIS software..
Access to Learning Media/ LMS and Offline and Online Percentage	Sync (google meet), Asynchronous (google classroom, video)
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. Computational Seismology: A Practical Introduction by Heiner Igel, Oxford University Press 2016. 2. Quantitative Seismology: Theory and Methods, Volumes I and II by KeiitiAki and Paul G. Richards. W. H. Freeman and Co., San Francisco.
Lecturers (*Team Teaching*)	1. Dr.rer.nat. Ade Anggraini, M.T. 2. Dr.rer.nat. Wiwit Suryanto, S.Si., M.Si. 3. 4.

Authorization	**Date of Drafting**	**Lecturer Coordinator**	**Head of Curriculum Committee**	**Head of Study Program**

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