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

Vulcanology

MFF5918 / 2 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
MFF5918	*Vulcanology*	*2*	*Even*	*Elective*	*None*

Short Description

Vulcanology course is Elective course 2 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. Nature of volcanism: the location of volcanoes in the world, the type of volcanoes, the frequency of erupting volcanoes, the rise of magma and eruptions, volcanic products and hazards for nuclear facilities, and monitoring of volcanoes.
2. Modern volcanological tools: movement of volcanoes - the moment of deformation to extremes, volcanology in the information age, brief survey reports on volcano monitoring, techniques, the introduction of sensors, and geodesy techniques.
3. Classical survey techniques: Early geodesy surveys, reference and data systems, geodesy networks, trilateration, and triangulation, leveling and tilt-leveling surveys, Photogrammetry, microgravity surveys, magnetic field measurements.
4. Continuous monitoring with on-site sensors: Seismometer, Tiltmeters, Strain meter, Continuous GPS, some warnings about near-surface deformation sensors, continuous gravimeter observations, and volcanic crater lake descent measurements.
5. Global Positioning System: Global positioning principles, GPS Overview, GLONASS, Galileo, GPS signal structure. GPS receiver. Combination and difference of data, using mathematics: transforming data into multiple positions, Relative position Engineering, CGPS network, data processing, looking into the future.
6. Interferometric synthetic-aperture radar (InSAR): Principles and techniques of radar, Principles of SAR interferometry.

The courses are held in class for 14 weeks, each week's session last for 2 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	Understand the concept of Earthquakes and Volcanoes.
	CO2	Understand the challenges of research on Volcano-Physics with Geophysical Methods.
	CO3	Master geophysical observation methods for active volcanoes.
	CO4	Apply Mountain Range modeling.
	CO5	Conduct a model of Merapi volcano based on changes in gravity data.
	CO6	
	CO7	
	CO8	

The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1	1. Worldwide distribution patterns of earthquakes and volcanoes 2. Types of Volcanoes 3. Volcanic Hazards 4. Types of Earthquakes	Lecture, discussion	2 x 50 minutes
	CO1	1. Earthquake Hazards 2. Volcanic Monitoring 3. Earthquake Monitoring 4. Volcanism	Lecture, discussion	2 x 50 minutes
	CO1	1. Plate Boundaries 2. Plate Tectonics 3. Tsunamis 4. Seismic Waves	Lecture, discussion	2 x 50 minutes
	CO2	1. Seismology – cornerstone of volcano monitoring 2. Volcano geochemistry 3. Volcano geophysics	Lecture, discussion	2 x 50 minutes
	CO2	1. Seismometers 2. Seismogram showing vertical surface motion recorded at Kevo, Finland 3. An introduction to seismic waves and earthquake types 4. Volcanic Earthquakes	Lecture, discussion	2 x 50 minutes
	CO2	1. Basic principles of seismometers 2. Tiltmeters	Lecture, discussion	2 x 50 minutes
	CO2	1. Some General Remarks about Monitoring Volcanoes	Lecture, discussion	2 x 50 minutes

		2. Geophysical Parameters 3. Seismic Activity 4. Deformation of the Surface 5. Tilt Meters 6. Satellite Radar Interferometry		
	CO3	1. Electronic Distance Measurement (EDM) 2. Global Positioning System (GPS) 3. Thermal Variations 4. Electrical, Magnetic and GravitationalVariations 5. Microgravity surveys: Physical principles	Lecture, discussion	2 x 50 minutes
	CO3	1. Merapi as a member of an active volcano family in Central Java 2. In fact, many curious questions are still challenging 3. Common questions from people living around the Merapi are about their needs	Lecture, discussion	2 x 50 minutes
	CO3	1. Furthermore, the Merapi is not an isolated system, neither in space domain nor in time domain 2. Prediction in a certain probability is not an impossible mission 3. Merapi is always inspiring, morning view from Cangkringan, June 11, 2006.	Lecture, discussion	2 x 50 minutes
	CO4	1. In principal there are three phases on disaster chronology 2. Alert levels in Merapi volcano 3. Merapi Seismicity	Lecture, discussion	2 x 50 minutes
	CO4	1. Merapi Enigma 2. Morphology and Structure 3. Merapi Cataclismic Eruption in 2006 4. The Changing Conditions 5. Epilogues	Lecture, discussion	2 x 50 minutes
	CO4	1. Introduction 2. Izmit August 17, 1999 M 7.6 earthquake 3. Prerequisite of new Discovery 4. Definition of Fluorescence 5. First results of waters of Izmit Earthquake Area 6. Results of fluorescence analyses	Lecture, discussion	2 x 50 minutes
	CO4	1. Of the Cascade Range volcanoes, Mount St. Helens 2. Chronological events of volcanic	Lecture, discussion	2 x 50 minutes

		activity that took place at Mt. St. Helens in the First -half of 1980 3. Chronological events of volcanic eruption at Mount St. Helens on 18th May 1980 4. Cost of Destruction by 1980-Eruption of St. Mt. Helen		
	Final Exam/ Project Task Results/ Case Analysis Results			
Learning Methods	Lecture, discussion			
Student Learning Experience	Learn to analyze and review: 1. Worldwide distribution patterns of earthquakes and volcanoes 2. Types of Volcanoes 3. Volcanic Hazards 4. Types of Earthquakes, 1. Earthquake Hazards 2. Volcanic Monitoring 3. Earthquake Monitoring 4. Volcanism, 1. Plate Boundaries 2. Plate Tectonics 3. Tsunamis 4. Seismic Waves, 1. Seismology – cornerstone of volcano monitoring 2. Volcano geochemistry 3. Volcano geophysics, 1. Seismometers 2. Seismogram showing vertical surface motion recorded at Kevo, Finland 3. An introduction to seismic waves and earthquake types 4. Volcanic Earthquakes, 1. Basic principles of seismometers 2. Tiltmeters, 1. Some General Remarks about Monitoring Volcanoes 2. Geophysical Parameters 3. Seismic Activity 4. Deformation of the Surface 5. Tilt Meters 6. Satellite Radar Interferometry, 1. Electronic Distance Measurement (EDM) 2. Global Positioning System (GPS) 3. Thermal Variations 4. Electrical, Magnetic and GravitationalVariations 5. Microgravity surveys: Physical principles, 1. Merapi as a member of an active volcano family in Central Java 2. In fact, many curious questions are still challenging 3. Common questions from people living around the Merapi are about their needs, 1. Furthermore, the Merapi is not an isolated system, neither in space domain nor in time domain 2. Prediction in a certain probability is not an impossible mission 3. Merapi is always inspiring, morning view from Cangkringan, June 11, 2006., 1. In principal there are three phases on disaster chronology 2. Alert levels in Merapi volcano 3. Merapi Seismicity, 1. Merapi Enigma 2. Morphology and Structure 3. Merapi Cataclismic Eruption in 2006 4. The Changing Conditions 5. Epilogues, 1. Introduction 2. Izmit August 17, 1999 M 7.6 earthquake 3. Prerequisite of new Discovery 4. Definition of Fluorescence 5. First results of waters of Izmit Earthquake Area 6. Results of fluorescence analyses, 1. Of the Cascade Range volcanoes, Mount St. Helens 2. Chronological events of volcanic activity that took place at Mt. St. Helens in the First -half of 1980			

	3. Chronological events of volcanic eruption at Mount St. Helens on 18th May 1980 4. Cost of Destruction by 1980-Eruption of St. Mt. Helen.
Access to Learning Media/ LMS and Offline and Online Percentage	Texts, presentations, pictures, assignments
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. B. Connor, N. A. Chapman, L. J. Connor, 2009, Volcanic And Tectonic Hazard Assessment For Nuclear Facilities Volcanic And Tectonic Hazard Assessment For Nuclear Facilities, Published in the United States of America by Cambridge University Press, New York. 2. Daniel Dzurisin, 2007, Volcano Deformation, Geodetic Monitoring Techniques, United States Geological Survey, Praxis Publishing Ltd, Chichester, UK.
Lecturers (*Team Teaching*)	1. Dr. Ing. Ari Setiawan, M.Si. 2. 3. 4.

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