



<b>Short Course Description</b>	Indonesia's geographical position and geological conditions produce a series of active volcanoes and provide a high probability of a volcanic eruption. Therefore, Volcano Physics discusses physical and non-physical problems related to the science of volcanoes. The lecture approach is phenomenological with an emphasis on the physical aspects of volcanoes. Discussion topics in lectures include: tectonic activity, types of volcanoes, magmatic activity, types of volcanic eruptions, primary and secondary dangers of eruptions, impacts and risks of eruptions, mitigation efforts in the context of volcanic eruption disaster risk reduction programs.						
<b>References</b>	<b>Main :</b>						
	<ol style="list-style-type: none"> <li>1. Farndon, J. et al. 2003. Planet Earth. London, UK: Lorenz Books.</li> <li>2. Robinson, A. 2002. Earth Shock. London, UK: Thames and Hudson Limited.</li> <li>3. Prastowo, T. 2012. Sains Kebumian. Unpublished work.</li> </ol>						
	<b>Supporters:</b>						
	<ol style="list-style-type: none"> <li>1. Scarth, A. 2001. Savage Earth. London, UK: Harper Collins Publishers.</li> </ol>						
<b>Supporting lecturer</b>	Prof. Tjipto Prastowo, Ph.D. Arie Realita, M.Si. Muhammad Nurul Fahmi, S.Si., M.Si.						
Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [ Estimated time]		Learning materials [ References ]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline ( offline )	Online ( online )		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Able to understand that Indonesia is in the Pacific Ring of Fire region with the geological consequences of having a row of active volcanoes	Students are able to explain that Indonesia is a country located in the Pacific Ring of Fire with geological consequences of having a row of active volcanoes	<b>Criteria:</b> quantitative  <b>Form of Assessment :</b> Participatory Activities	• Lecture• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Plate tectonic theory, Pacific Ring of Fire, Volcanic formations, Indonesian geological systems and conditions. <b>Reference:</b> Prastowo, T. 2012. Earth Science. Unpublished work.	2%
2	Able to understand the physical and non-physical aspects of volcanoes, understand the types of volcanoes in Indonesia	Students are able to explain the physical and non-physical aspects of volcanoes, understand the types of volcanoes in Indonesia	<b>Criteria:</b> quantitative  <b>Form of Assessment :</b> Participatory Activities	• Lecture• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Physical and non-physical aspects of volcanoes, Types of active volcanoes in Indonesia <b>Reference:</b> Prastowo, T. 2012. Earth Science. Unpublished work.	2%
3	Able to understand the influence of volcanic activity and magma content on types of volcanic eruptions, understand the impact of eruptions	Students are able to explain the influence of volcanic activity and magma content on types of volcanic eruptions, explain the impact of volcanic eruptions	<b>Criteria:</b> quantitative  <b>Form of Assessment :</b> Participatory Activities	• Lecture• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Volcanic activity, magma fluid content, eruption mechanism, types of active volcanic eruptions <b>References:</b> Prastowo, T. 2012. Earth Science. Unpublished work.	2%

4	Able to understand the influence of volcanic activity and magma content on types of volcanic eruptions, understand the impact of eruptions	Students are able to explain the influence of volcanic activity and magma content on types of volcanic eruptions, explain the impact of volcanic eruptions	<b>Criteria:</b> quantitative  <b>Form of Assessment</b> : Participatory Activities	• Lecture• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Volcanic activity, magma fluid content, eruption mechanism, types of active volcanic eruptions <b>References:</b> <i>Farndon, J. et al. 2003. Planet Earth. London, UK: Lorenz Books.</i>	2%
5	Able to understand geophysical processes related to volcanic eruptions, understand several indicators of the danger of volcanic eruptions (volcanic earthquake frequency, rate of ground cracking, toxic gas emissions)	Students are able to explain geophysical processes related to volcanic eruptions, explain several indicators of the danger of volcanic eruptions (volcanic earthquake frequency, rate of ground fractures, toxic gas emissions)	<b>Criteria:</b> quantitative  <b>Form of Assessment</b> : Participatory Activities	• Lecture• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Geophysical processes related to volcanic eruptions Eruption indicators, Volcanic earthquakes, Physical deformation of the land surface, Volcanic gas emissions <b>References:</b> <i>Farndon, J. et al. 2003. Planet Earth. London, UK: Lorenz Books.</i>	2%
6	Able to understand geophysical processes related to volcanic eruptions, understand several indicators of the danger of volcanic eruptions (volcanic earthquake frequency, rate of ground cracking, toxic gas emissions)	Students are able to explain geophysical processes related to volcanic eruptions, explain several indicators of the danger of volcanic eruptions (volcanic earthquake frequency, rate of ground fractures, toxic gas emissions)	<b>Criteria:</b> 1.Collection of short articles related to Volcano Physics lectures 2.Group article assessment rubric 3.Group marks are given when articles are collected  <b>Forms of Assessment</b> : Participatory Activities, Project Results Assessment / Product Assessment	• Lecture• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Geophysical processes related to volcanic eruptions Eruption indicators, Volcanic earthquakes, Physical deformation of the land surface, Volcanic gas emissions <b>References:</b> <i>Prastowo, T. 2012. Earth Science. Unpublished work.</i>	2%
7	Able to understand geophysical processes related to volcanic eruptions, understand several indicators of the danger of volcanic eruptions (volcanic earthquake frequency, rate of ground cracking, toxic gas emissions)	Students are able to explain geophysical processes related to volcanic eruptions, explain several indicators of the danger of volcanic eruptions (volcanic earthquake frequency, rate of ground fractures, toxic gas emissions)	<b>Criteria:</b> quantitative  <b>Form of Assessment</b> : Participatory Activities	• Lecture• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Geophysical processes related to volcanic eruptions Eruption indicators, Volcanic earthquakes, Physical deformation of the land surface, Volcanic gas emissions <b>References:</b> <i>Robinson, A. 2002. Earth Shock. London, UK: Thames and Hudson Limited.</i>	2%

8	Able to understand USS questions well	Students are able to solve USS questions well	<p><b>Criteria:</b> 100 marks if the USS questions are answered well and correctly</p> <p><b>Forms of Assessment :</b> Participatory Activities, Project Results Assessment / Product Assessment</p>	<ul style="list-style-type: none"> <li>• Written test, open book</li> <li>• Discussion on USS questions</li> <li>100 minutes</li> </ul>		<p><b>Material:</b> Midterm Exam</p> <p><b>Literature:</b></p>	20%
9	Able to understand the primary and secondary dangers of volcanic eruptions, the impact and risks of eruptions, understand mitigation efforts in the context of reducing the risk of volcanic eruptions	Students are able to explain the primary and secondary dangers of volcanic eruptions, the impacts and risks of eruptions, understand mitigation efforts in the context of reducing the risk of volcanic eruptions.	<p><b>Criteria:</b> Full marks if articles are collected</p> <p><b>Forms of Assessment :</b> Participatory Activities, Project Results Assessment / Product Assessment</p>	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Discussion</li> <li>• Question and answer</li> <li>2 X 50 minutes</li> </ul>		<p><b>Material:</b> Primary and secondary hazards, Eruption impacts and risks, Eruption disaster mitigation studies, Eruption disaster risk reduction</p> <p><b>References:</b> <i>Scarth, A. 2001. Savage Earth. London, UK: Harper Collins Publishers.</i></p>	13%
10	Able to understand the primary and secondary dangers of volcanic eruptions, the impact and risks of eruptions, understand mitigation efforts in the context of reducing the risk of volcanic eruptions	Students are able to explain the primary and secondary dangers of volcanic eruptions, the impacts and risks of eruptions, understand mitigation efforts in the context of reducing the risk of volcanic eruptions.	<p><b>Criteria:</b> Full marks if articles are collected</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Discussion</li> <li>• Question and answer</li> <li>2 X 50 minutes</li> </ul>		<p><b>Material:</b> Primary and secondary hazards, Eruption impacts and risks, Eruption disaster mitigation studies, Eruption disaster risk reduction</p> <p><b>References:</b> <i>Prastowo, T. 2012. Earth Science. Unpublished work.</i></p>	2%
11	Able to understand efforts to monitor eruption hazards with monitoring instruments, understand the correlation between eruption hazard indicators and eruption opportunities by utilizing the Eruption application	Students are able to explain the mechanism for monitoring the danger of volcanic eruptions using several monitoring instruments, understand the correlation between eruption danger indicators and the opportunity for an eruption to occur by using the Eruption application	<p><b>Criteria:</b> quantitative</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Discussion</li> <li>• Question and answer</li> <li>2 X 50 minutes</li> </ul>		<p><b>Material:</b> Monitoring volcanic activity, Measuring instruments for monitoring volcanic activity, Prediction of eruption potential based on monitoring volcanic activity</p> <p><b>References:</b> <i>Scarth, A. 2001. Savage Earth. London, UK: Harper Collins Publishers.</i></p>	2%

12	Able to understand efforts to monitor eruption hazards with monitoring instruments, understand the correlation between eruption hazard indicators and eruption opportunities by utilizing the Eruption application	Students are able to explain the mechanism for monitoring the danger of volcanic eruptions using several monitoring instruments, understand the correlation between eruption danger indicators and the opportunity for an eruption to occur by using the Eruption application	<b>Criteria:</b> quantitative  <b>Form of Assessment :</b> Participatory Activities	• Lecture• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Monitoring volcanic activity, Measuring instruments for monitoring volcanic activity, Prediction of eruption potential based on monitoring volcanic activity <b>References:</b> <i>Prastowo, T. 2012. Earth Science. Unpublished work.</i>	2%
13	Able to understand various issues related to physical and non-physical problems of volcanoes in Indonesia, including disaster mitigation efforts to reduce the impact and risk of volcanic eruptions	Students are able to explain various issues through posters related to physical and non-physical problems of volcanoes in Indonesia, including disaster mitigation efforts to reduce the impact and risk of volcanic eruptions	<b>Criteria:</b> Full marks if the poster is presented at the end of the semester  <b>Forms of Assessment :</b> Participatory Activities, Project Results Assessment / Product Assessment	• Poster Presentation• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Monitoring volcanic activity, Measuring instruments for monitoring volcanic activity, Prediction of eruption potential based on monitoring volcanic activity <b>References:</b> <i>Farndon, J. et al. 2003. Planet Earth. London, UK: Lorenz Books.</i>	13%
14	Able to understand various issues related to physical and non-physical problems of volcanoes in Indonesia, including disaster mitigation efforts to reduce the impact and risk of volcanic eruptions	Students are able to explain various issues through posters related to physical and non-physical problems of volcanoes in Indonesia, including disaster mitigation efforts to reduce the impact and risk of volcanic eruptions	<b>Criteria:</b> Full marks if the poster is presented at the end of the semester  <b>Forms of Assessment :</b> Participatory Activities, Project Results Assessment / Product Assessment	• Poster Presentation• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Volcano Physics Poster <b>Reference:</b> <i>Prastowo, T. 2012. Earth Science. Unpublished work.</i>	2%
15	Able to understand various issues related to physical and non-physical problems of volcanoes in Indonesia, including disaster mitigation efforts to reduce the impact and risk of volcanic eruptions	Students are able to explain various issues through posters related to physical and non-physical problems of volcanoes in Indonesia, including disaster mitigation efforts to reduce the impact and risk of volcanic eruptions	<b>Criteria:</b> Full marks if the poster is presented at the end of the semester  <b>Forms of Assessment :</b> Participatory Activities, Project Results Assessment / Product Assessment	• Poster Presentation• Discussion• Question and answer 2 X 50 minutes		<b>Material:</b> Volcano Physics Poster <b>Reference:</b> <i>Prastowo, T. 2012. Earth Science. Unpublished work.</i>	2%

16	Able to understand UAS projects well	Students can make posters that are relevant to the Volcano Physics lecture topic; have an independent and honest character in carrying out the tasks of making posters and presenting lectures on Volcano Physics	<b>Criteria:</b> 1.Collection of videos of scientific poster presentations related to Volcano Physics lectures (individual) 2.Individual presentation video assessment rubric 3.Individual marks are given when video presentations are collected  <b>Form of Assessment :</b> Project Results Assessment / Product Assessment	Presentation Poster Discussion Question and answer 100 minutes		<b>Material:</b> Volcano Physics Poster <b>Literature:</b>	30%
----	--------------------------------------	---	--	---	--	--	-----

#### Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	44%
2.	Project Results Assessment / Product Assessment	56%
		100%

#### Notes

- Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
- The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
- Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
- Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
- Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
- Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
- Forms of assessment:** test and non-test.
- Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
- Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
- Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
- The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
- TM=Face to face, PT=Structured assignments, BM=Independent study.