INOVASI MODEL PEMBELAJARAN

Course Modul of FUNDAMENTAL OF SOIL SCIENCE

EVEN SEMESTER 2021/2022

course coordinator:
Dr.Ir. Bakti Wisnu Widjajani

Teaching team:
Dr.Ir. Rossyda Priyadarshini, MP., Ir. Siswanto, MT., Ir. Purwadi, MP., Ir. Setyobudi S., MP., Ir. Purnomo Edi S., MP., Dr.Ir. Maroeto, MP., Ir. Supamrih, MMA., Haidar Fari Aditya, MP.

Study Program of Agrotechnology, Faculty of Agriculture
University of Pembangunan Nasional "Veteran" East Java
Jalan Raya Rungkut Madya-Gunung Anyar.Surabaya

2021

Daftar Isi

1 EDUCATION LEARNING OUTCOME (ELO)

ELO-A1	*be defending country character, namely the love of the motherland, national and state awareness, believes in Pancasila as the ideology of the state, willing to sacrifice for the nation and the state, and has the initial ability to defend the country.*
ELO-A2	*Responsible for work in the field of expertise independently*
ELO-A3	*able to maintain and develop collaborative networks with supervisors, colleagues, colleagues both inside and outside the institution;*
ELO-4	*able to apply knowledge of Plant Sciences and basic concepts of Plant Production, Soil and basic concepts of land resources, the concept of crop protection against pests and diseases in an integrated manner*
ELO-5	*able to master the principles of the application of agricultural technology to solve problems in agriculture*
ELO-6	*able to analyze, plan and implement lowland farming systems refers to the principles of sustainable agriculture, modern , raise local wisdom, effectively and productively*
ELO-7	*able to study the implementation of sustainable agriculture systems Base on scientific rules aplication, procedures and ethics in order to produce solutions, ideas, and designs based on the results of information and data analysis*
ELO-8	*The ability to master plant propagation technology, and crop management in accordance with the agro-climate zone*
ELO - 9	*The ability to identify, formulate, analyze and solve problems in the field of land resources*
ELO - 10	*Ability to diagnose, analyze and solve plant pest problems*
ELO - 11	*The ability to handle the current principles and issues of lowland agriculture and its environmental problems*
ELO - 12	*Mastery of technology and be able to communicate with the community in solving agricultural problems both oral and written*

2. COURSE IDENTIFICATION

1. Name of course, Code,
2. ELO performance Indicator
3. ELO charged to the Constitutional Course, this data can be obtained from the ELO course matrix
4. Learning Model used
5. Assessment Form

Name of course	:	FUNDAMENTAL OF SOIL SCIENCE
Code of course	:	FP191107
Semester credit unit	:	3
Learning Model	:	Tutorial and discus Disccuse group Learning Individual learning Field and laboratory practise Problem base learning/project base learning evaluations
		ELO-A 2: *Responsible for work in the field of expertise independently* ELO-P 1:*Ability to handle the current principles and issues of lowland agriculture and its environmental problems* ELO-P 2:*Mastery of technology and be able to communicate with the community in solving agricultural problems both oral and written* ELO-K 5:*able to master the principles of the application of agricultural technology to solve problems in agriculture*

ELO	Performance Indicator
ELO A2	Able to describe the basic concepts of soil characteristics and environmental management
ELO P1	Able to understand soil problems, especially in lowland agriculture
ELO P2	able to solve problems / to find problem solving for problems in agriculture, especially soil science
ELO K5	Able to identify land problems in the field of soil science Have skills in conducting land surveys to solve environmental problems, especially those related to soil

3. SEMESTER LEARNING PLAN

3.1 Determination of ELO Weight on Course

<table>
<tr><td></td><td colspan="7">UNIVERSITY OF PEMBANGUNAN NASIONAL “VETERAN” EAST JAVA
FACULTY OF AGRICULTURE
STUDY PROGRAM OF AGROTECHNOLOGY
LEVEL STUDY PROGRAM : GRADUATE</td></tr>
<tr><td colspan="2">Course</td><td>CODE</td><td>COURSE CLUSTER</td><td colspan="2">Weight (sks)</td><td>SEMESTER</td><td>Date of Forming</td></tr>
<tr><td colspan="2">Fundamental of Soil Science</td><td>FP-191107</td><td>Soil Science</td><td>2</td><td>1</td><td>II (Two)</td><td></td></tr>
<tr><td colspan="2" rowspan="2">AUTHORIZATION</td><td colspan="2">Developer of RP</td><td colspan="2">Coordinator of Course Learning Outcome</td><td colspan="2">Coordinator of Study Program</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Learning Outcome (LO)</td><td colspan="7">Study Programs that are charged to the Course
ELO-A 1: be defending country character, love of the motherland, national and state awareness, believes in Pancasila as the ideology of the state, willing to sacrifice for the nation and the state, and has the initial ability to defend the country
ELO-P 1: Ability to handle the current principles and issues of lowland agriculture and its environmental problems
ELO-P 2: Mastery of technology and be able to communicate with the community in solving agricultural problems both oral and written
ELO-K 5: able to master the principles of the application of agricultural technology to solve problems in agriculture</td></tr>
<tr><td></td><td colspan="7">ELO Course ;
Students are able to descript soil forming concept, descript physic, chemical and biological soil’s</td></tr>
</table>

	characteristic, nutrition and fertilizing concept, and also analize and tell their opinion about soil and environmental issue.
Course Description	Concept and descript about soil as natural resources and as plant's growing medium. Process, factors and development of soils. Physic, Chemical, Biological soil's properties and soil's organic matter. Plant's nutrition fundamental, soil's fertility and fertilizer. Soil and water conservation's fundamental. Land's management and relationship between soil science and environmental
Course / Study Material	Soil's forming and component, soil's profile, physic, chemical and biological soil's properties, soil's nutrition cycle, fertilizer and fertilizing, soil and environmental's issue according to learning study materials
References :	**Main:** 1. Sutanto, R. 2005. Dasar-dasar Ilmu Tanah: Konsep dan Kenyataan. Kanisius. Yogyakarta. 2. Sarief, S. 1979. Ilmu Tanah Umum. Faperta Unpad. Bandung. 3. Notohadipoero, A. R. S. 1980. Pengantar Ilmu Tanah. Faperta UGM. Yogyakarta. **Supported :** 4. Hardjowigeno, S. 1993. Klasifikasi Tanah Dan Pedogenesis. Akademika Pressindo. Jakarta. 5. Rosmarkam, A. & N.W. Yuwono 2002. Ilmu Kesuburan Tanah. Kanisius. Yogyakarta. 6. Arsyad, S. 1976. Pengawetan Tanah. IPB. Bogor.
Learning Media	**Software :** / **Hardware :**
Team Teaching	Dr. Ir. Bakti Wisnu W., MP.; Dr. Ir. Rossyda P., MP.; Ir. Siswanto, MT.; Ir. Supamrih, MMA.; Ir. Setyo Budi S., MP.; Ir. Purwadi, MP., Ir. Purnomo Edi Sasongko, MP.; Dr.Ir. Maroeto, MP.
Requirement Course	

Week to	**Final abilities at each learning stage (Sub-ELO Course)**	**Evaluation**		**Forms of Learning, Learning Methods and Student Assignments [Estimated time]**		**Learning materials [References]**	**Weight (%)**
		Evalution's Indicators	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

1	Able to descript definitions/concept of soil's component and function as fundamental of soil science (C2, A4)	Students are able to descript component and function of soils Soil's Concept 1. Definition of soils (pedology and edafology) 2. Soil's arrangement 3. Soil as natural resources and plant's growing medium 4. Develompment of soil sciences	**Non test** Make summaries and make flowcart about component and function of soil	Watch video from Youtube https://www.youtube.com/watch?v=ReiDEB7CDE0 about Introduction to soil and weathering	Course Explaining course's plan and Module	1, 4	6%
				Classical = 2 x 50 minutes **Structured Assigment = 60 minutes** **Indipendent Learning = 60 minutes**			
2, 3	Able to descript " soil forming process and influencing factors" concept (C2, A3)	Students are able to know the process and explain factors of soil's forming Forming and soil's development 1. Materials of soil's forming 2. Soil Parent Materials 3. Factors of soil's forming 4. Soil's forming process 5. Soil Profile 6. Soil Taxonomy	**Non tes** **Assignment** 1. Observation of student's participation in disscusion 2. Able to explain discussion result 3. Resume and answer the questions or make mind map, etc.	Watch video from Youtube https://www.youtube.com/watch?v=tgoD0FfE_FU about forming soil process	- Explain power point/ video's course - Make group discussion and discuss about process and soil's forming factors	1, 2, 4	6%
				Classical = 2 x 50 minutes **Structured Assigment = 60 minutes** **Indipendent Learning = 60 minutes**			

4,5	Able to determine soil's component according Soil's physic characteristics (C3, P4)	Students are able to know and explain soil physic component Soil physic properties 1. Soils Texture 2. Soils Structure 3. Relationship of soil weight and volume (Volume density, Bulk Density, porosity) 4. Soil consistency 5. Ground air 6. Soil temperature 7. Soil color 8. Groundwater	**Non test Assignments** 1. Observation of student participation in discussions **2.** the ability to convey the results of the discussion	Watch video from Youtube https://www.youtube.com/watch?v=D8ex1r7axso&https://www.youtube.com/watch?v=yRPnEiW5mIc about soil physic	- **Explain / lecture material video** - **Creating groups and group discussions**		5% 20%
				Course **Practice** **Classical= 2 x 2 x 50** **2 x 1 x 100** **Structured Assigment = 2 x 60** **2 x 1 x 70** **Indipendent Learning = 2 x 60**			
6	Able to classify the components of clay minerals in the soil (C3, A4)	Students are able to know and explain the components of clay minerals Clay Minerals 1. Understandin 2. Role 3. Load source 4. Types and characteristics	**Non test Assignments** 1. Observation of student participation in discussions **2.** the ability to convey the results of the discussion	Watch video from Youtube https://www.youtube.com/watch?v=nSmA-kBhPj0 about clay mineralogy	- Explain of power point / lecture material videos - Create groups and group discussions		5% 20%
				Course **Practice** **Classical= 2 x 2 x 50** **2 x 1 x 100** **Structured Assigment = 2 x 60** **2 x 1 x 70** **Indipendent Learning = 2 x 60**			
7	Able to determine soil components based on soil chemical properties (C3, P4)	Students are able to know and explain the components of soil chemical properties Soil Chemical Properties 1. Chemical	**Non test Mengumpulkan tugas** 1. Observation of student participation in	Watch Video From Youtube https://www.youtube.com/watch?v=CijD5qmeD_Yt entang soil chemical	- Explain of power point / lecture material videos - Create groups and group		5% 20%

		constituents of soil 2. The periodic system of the elements that make up the soil 3. Chemical bond 4. Valence 5. Electromagnetivity 6. Nest Series	discussions 2. the ability to convey the results of the discussion	properties	discussions **Course** **Practice** **Classical= 2 x 2 x 50** **2 x 1 x 100** **Structured Assigment = 2 x 60** **2 x 1 x 70** **Indipendent Learning = 2 x 60**		
8	Midterm Exam						
9	Able to determine soil components based on soil chemical properties (C3, P4)	Students are able to know and explain the components of soil chemical properties Soil chemical properties 1. Soil CEC 2. Soil pH 3. EC ground 4. alkaline soil and acid soil 5. Soil buffer 6. Liming 7. Acidification	**Non test** **Assignments** 1. Observation of student participation in discussions 2. The ability to convey the results of the discussion	Watch video from Youtube https://www.youtube.com/watch?v=M7YRIdk5q70 about soil chemistry	- Explain power point / lecture material video - Creating groups and group discussions **Course** **Practice** **Classical= 2 x 2 x 50** **2 x 1 x 100** **Structured Assigment = 2 x 60** **2 x 1 x 70** **Indipendent Learning = 2 x 60**		
10, 11	Able to determine and formulate soil components based on soil biological properties (C3, P4)	Students are able to know and be able to explain the components/biological properties of soil Soil Biological Properties 1. Classification of living bodies 2. the role of living bodies	**Non test** **Collect assignments** 1. Observation of student participation in discussions 2. the ability to convey the results of the discussion	Watch video from Youtube https://www.youtube.com/watch?v=98ZGaT7C6io about soil biology	- Explain Power point/ lecture material videos - Create groups and group discussions **Course** **Classical= 2 x 50** **Structured Assigment = 60** **Indipendent Learning = 60**		

		3. Sources of BO 4. Process and results of weathering 5. role and factors of soil BO 6. C/N Ratio				
12-13	Able to determine and classify components of plant nutrition, as well as fertilizer and determine the type and method of fertilization (C3, A4, P5)	1. Students are able to know and recognize the nutritional components of plants 2. Students are able to explain the types of fertilizers and fertilization methods	**Non testt** **Assignments** 1. Observation of student participation in discussions 2. The ability to convey the results of the discussion	Watch Video from youtube https://www.youtube.com/watch?v=iphOwk3yn10 about plant nutrition https://www.youtube.com/watch?v=TjbxOEEOCh0 about fertilizer and soil fertility **Course** **Classical= 2 x 50** **Structured Assigment = 60** **Indipendent Learning = 60**	- Explain Power point/ lecture material videos - Create groups and group discussions	
13	Able to explain and choose how to conduct land surveys and determine land evaluation (C2, A2, P5)	Students are able to know and be able to explain about land survey and evaluation	**Non test** **Assignments** 1. Observation of student participation in discussions 2. The ability to convey the results of the discussion	**Course** **Practice** **Classical= 2 x 50** **2 x 1 x 100** **Structured Assigment = 2 x 60** **2 x 1 x 70** **Indipendent Learning = 2 x 60**	- Explain Power point/ lecture material videos - Create groups and group discussions	

14	Able to consider and combine soil and water conservation strategies (C5, A4)	Students are able to determine the conservation of soil and water mechanically (physical), chemical and vegetation (biology) Soil and Water Conservation 1. Definition of Conservation 2. Biological Conservation 3. Chemical Conservation 4. Physical Conservation	**Non test Assignments** 1. Observation of student participation in discussions 2. The ability to convey the results of the discussion	Watch Video from Youtube https://www.youtube.com/watch?v=QHyK2M8yiQE about soil conservation	- Explain Power point/ lecture material videos - Create groups and group discussions		
				Course **Classical= 2 x 50** **Structured Assigment = 60** **Indipendent Learning = 60**			
15	Able to analyze and express opinions on land & environmental problems and determine problem solving strategies (C4, A4, P5)	Students can identify environmental issue and diagnose the causes of issue, and then describe how to deal with issue based on knowledge of soil science Soil Science and Environmental Management 1. Identify environmental problems 2. The role of soil science 3. Diagnose and treat	**Non test Assignments** 1. Observation of student participation in discussions 2. The ability to convey the results of the discussion	Watch video from Youtube https://www.youtube.com/watch?v=8kZXulLobA8 about why soil matters	- Explain Power point/ lecture material videos - Create groups and group discussions		
				Course **Classical= 2 x 50** **Structured Assigment = 60** **Indipendent Learning = 60**			

		environmental problems				
16	**End of Semester Evaluation** **Evaluation of the achievement of ELO imposed on the course**					
Total						

4. Result of ELO weight calculation

No	Sem	Course Code	Course	scs	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7	ELO8	ELO9	ELO10	Total
	II		Fundamental of Soil Science	3											

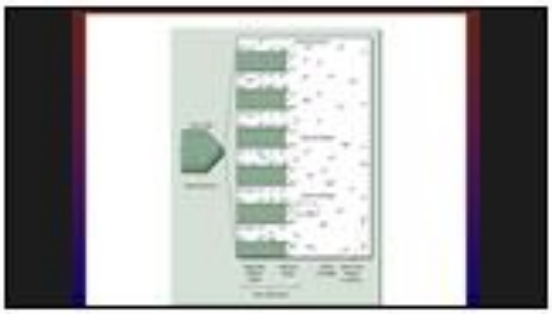
5. ASSESSMENT AND EVALUATION PLAN

	ASSESSMENT AND EVALUATION PLAN Graduate Study Program : Agrotechnology **Fundamental of Soil Science**		**RA&E** Edisi:
Code: FP191108	**SCS weight (C/P): (2/1)**	**Course Cluster: Soil Science**	Smt: 2
AUTHORIZATION	**RA & E Compiler** **Dr.Ir. Bakti Wisnu W.**	**Coordinator of RA&E** **Dr.Ir. Bakti Wisnu W.**	**Coordinator of Study Program** **Dr.Ir. Bakti Wisnu W.**

Week **(1)**	**Sub CLO** **(2)**	**Assestmen Form** **(3)**	**Weight(%)** **(4)**
1	Able to describe the understanding/concept of soil components and functions as the basis of soil science	**Assigment 1:** **Non test** Compile summaries and create basic soil science flowcharts	**5%**
2, 3	Able to discuss collaboratively the concept of "soil formation process and influencing factors"	**Assigment 2** **Non test** 1. Observation of student participation in discussions 2. The ability to convey the results of the discussion 3. Make a summary, answer questions or make a mind map	**5%**

4, 5	Able to determine soil components based on soil physical properties		
5			
6			
7			
8			

TEACHING MATERIALS



CEC

Cations can move on and off particles . . .

when one leaves, another replaces it

This process is called cation exchange, and cations involved are said to be exchangeable

CEC

may range from

2.0 mEq/100g for sand

to

> 50 mEq/100g for some clays

humus 100-300 mEq/100g

CATION EXCHANGE REACTIONS

Principle of Cation Exchange: Mg^{++} is Replaced by Na^{+}

CEC

How fertile can a soil be?

Does applying more fertilizer always provide more nutrients to plants?

How much of the CEC is actually filled with cations?

CEC

The number of sites that a colloid (small particle) of charged clay or humus (micelles) contains is measured by the:

Cation Exchange Capacity expressed in mEq/100g

Note: newer units expressed in cmol$_c$/kg

CEC

The proportion of the CEC occupied by basic (+) nutrients such as Ca, Mg, K, Na, is called:

Percent Base Saturation and is an indication of the potential CEC of a given soil

CEC

Estimations that > 99% of cations in soil solution are adsorbed . . .

does **not** mean that percent base saturation is 99%

CEC

Cation Exchange is determined by:

1) strength of adsorption

2) law of mass

CEC

Example:

A soil with CEC of 10 mEq/100g has 6 mEq/100g of bases (Ca, Mg, K, Na) occupying exchange sites

What is the *percent base saturation* of the soil?

CEC

Strength of adsorption is as follows:

H^+ and $Al^{3+} > Ca^{2+} > Mg^{2+} > K^+ > NH^+ > Na^+$

CEC

6 mEq/100g bases

10 mEq/100g sites

= *60 %* base saturation

CEC

Law of Mass

the more of one ion available,

the greater the chance of adsorption


NUTRITION
Nutrients grouped into 2 categories according to the relative amount used by plants:
– major elements; large amounts
– minor elements; small amounts
Both are essential for optimal plant production


NUTRITION
Except for C, H, O . . .
- Nitrogen (N) is present in greatest concentrations;
- Plants respond readily to Nitrogen (N)


NUTRITION
Note:
C, H, O . . .
essential elements not considered in nutritional studies;
Why?


NUTRITION
> 95% of plant dry wt. from C, H, O;
(balance from macro, micro and other elements)