Module Description/Course Syllabi

Study Programme : Magister of Soil Science
Department of Soil Science and Land Resources
Faculty of Agriculture Universitas Andalas

1. *Course number and name*

MIT 81104 Dynamics of Clay Minerals and Colloids

2. *Credits and contact hours/Number of ECTS credits allocated*

3 scs (2-1) / 3,621

3.Instructors and course coordinator

1. Prof.Dr.Ir. Dian Fiantis, MSc
2. Prof. Dr. rer.nat. Ir. Syafrimen Yasin, MS, MSc

4. Text book, title, author, and year

1. Bergaya, F., G. Lagally. 2013. Handbook of Clay Science, Volume 5 PartA Fundamental, Elsevier, Amsterdam, 875 hal.
2. Bergaya, F., G. Lagally. 2013. Handbook of Clay Science, Volume 5 PartB Techniques and Applications, Elsevier, Amsterdam, 813 hal.
3. Bhaskar Ghosh, Dola Chakraborty. 2023. Clay Minerals.. Springer, Berlin. 476..
4. Velde, B. B., A. Meunier. 2008. The origin of clay minerals in soils and weathered rocks. Springer. Berlin. 426 hal.
5. Waseda, Y., E. Matsubara, K. Shinoda. Z-Ray Diffraction Crystallography: Introduction, Examples and Solved Problems.Sprinfer-Verlag BerlinHeidelberg. London New York. 322 hal.
6. Mineralogical Society of America, 2001. Handbook of Mineralogy. Prentice Hall.484 hal.
7. Dixon, B., Weeds, S.B. 1989. Minerals in Soil Environment. Soil Science Society of America.
8. Fiantis D., Ginting F.I., Seprianto, Halfero F., Saputra A.P., Nelson M., Van Ranst E., Minasny B. (2021). Geochemical and mineralogical composition of the 2018 volcanic deposits of Mt. Anak Krakatau. Geoderma Regional, 25, art. no. e00393. DOI: 10.1016/j.geodrs.2021.e00393.
9. Fiantis D., Ginting F.I., Gusnidar, Nelson M., Minasny B. (2019). Volcanic Ash, insecurity for the people but securing fertile soil for the future. Sustainability (Switzerland), 11 (11), art. no. 3072.
10. Fiantis D., Nelson M., Shamshuddin J., Goh T.B., van Ranst E. (2011). Changes in the chemical and mineralogical properties of Mt. Talang volcanic ash in West Sumatra during the initial weathering phase.

Communications in Soil Science and Plant Analysis, 42 (5), pp. 569 – 585.
11. Kautsar F.R., Ilham D.J., Prasetyo T.B., Juniarti, **Fiantis D**. (2024). Identification and characterization of tephra for geopolymer precursor. IOP Conference Series: Earth and Environmental Science, 1306 (1), art. no. 012018.

5. Specific course information

A. ***Brief description of the content of the course (catalog description)***

This course discusses the meaning of minerals, physical and chemical properties as well as characteristics and systematics of minerals, mineral stability and weathering, formation and classification of clay minerals, origin and characteristics of clay minerals, the relationship between clay minerals and chemistry, genesis as well as classification of soil, principles of determination and analysis of clay minerals, and mineral applications in agriculture.

B. Course Content

1 Meaning and role of clay minerals, factors affecting clayminerals, the history of clay mineral
2 Genesis of clay minerals: physical and chemical weathering,and factors affection the formation
3 Crystalline structure of clay minerals and the chemical properties, clay surface chemicals : intra and inter clayminerals
4 Clay minerals-organic matter interaction
5 Clay minerals and pesticides, role of clay minerals forreducing soil pollution
6 & 7 Identification and quantitative analyses of clayminerals using:
a. X-ray Diffraction (XRD),
b. X-ray Fluorescence (XRF)
c. Fourier Transform Infrared Spectroscopy (FTIR)
d. Scanning Electron Microscope (SEM) and TransmissionElectron Microscope (TEM)
e. Selective Dissolution Analysis
8 Mid Exam
9 Mineral soil colloids
10 Clay mineral type 2:1 : the Properties and thecharacteristics
11 Clay mineral type 1:1 : the Properties and the characteristics
12 Sources of clay mineral surface charge (Isomorphic substitution) and its correlation to soil chemical reaction
13 Properties and the characteristics of non-crystalline andpara-crystalline clay minerals
14 Properties and the characteristics of oxide and hydroxide minerals
15 Role of clay minerals on soil CEC value and classification
16 Final Exam

C. Semester when the course unit is delivered

Even Semester

D. Mode of delivery (face-to-face, distance learning)
Face to face
6. ***Intended Learning Outcomes (CPL)***
ILO 1: An ability to analyze and interpret nature and characteristics of many soils in determining the potency and the threat of the land and environment resources **PI 2** : An ability to analyze soil properties **PI 3** : An ability to interpret soil data
ILO 2 : An ability to classify soil, to evaluate land capability and suitability, as well as to determine the alternative utilization for sustainable agriculture and environment **P1 1** : An ability to classify soil properties
ILO 3 : An ability to use technology in identifying and solving problems of soil, land resource, environment problems independently, eligibly, and accurately **PI 2** : An ability to work independently in determining soil properties
7. Course Learning Outcomes (CPMK) *ex. The student will be able to explain the significance of current research about a particular topic.*
1. Students will be able to analyze properties of many soils 2. Students will be able to interpret data of many soils 3. Students will be able to use soil data to classify soils based on some methods of soil classification Students will be able to analyze soil independently either at laboratory or at field site
8. Learning and teaching methods
Cooperative Learning and Problem Base Method
9. Language of instruction
Bahasa Indonesia and English (English Class)
10. Assessment methods and criteria
Summative Assessment : ***1. Tasks : 5 %*** ***2. Quiz : 5 %*** ***3. Mid Semester : 25%*** ***4. Final Semester : 25%*** ***5. Practicum :30%*** ***6. Attendance : 5%*** ***Formative Assessment:*** ***1. Minutes paper***