



UNIVERSITI TEKNOLOGI MARA

AGR231: SOIL SCIENCE

Course Name (English)	SOIL SCIENCE APPROVED
Course Code	AGR231
MQF Credit	3
Course Description	This course will interactively engage students cognitively and scientifically in areas of soil physical, chemical and biological properties. Students will define concepts, describe theories verbally and in writing and be able to perform tests in the laboratory and discuss the results. The outcome shall be assessed through traditional paper examination, tests, assignment, classroom discussion and laboratory engagement.
Transferable Skills	Student able to identify the physical, chemical and biological properties of soils and relate the basic principles of soil science to plant growth and environment.
Teaching Methodologies	Lectures, Blended Learning, Lab Work, Demonstrations, Case Study, Simulation Activity
CLO	CLO1 State and discuss the physical, chemical and biological properties of soils CLO2 Identify, conduct and discuss the data and results of scientific investigations of common local soils CLO3 Represent and relate the basic principles of soil science and its relation to plant growth and environment
Pre-Requisite Courses	No course recommendations
Topics	
1. 1.0 Introduction 1.1) 1.1 Definition of soils, pedon, soil profile and soil horizons 1.2) 1.2 The role of soils to human and as source of food production and agricultural production in industry 1.3) 1.3 History of soil science 1.4) 1.4 Phases and components of soil 1.5) 1.5 Fields related to soil science: soil physics, soil chemistry, soil biology and soil conservation	
2. 2.0 Minerals and rocks 2.1) 2.1 Minerals in soils 2.2) 2.1.1 Types of minerals; primary and secondary minerals 2.3) 2.1.2 The importance in supplying nutrients to the soils 2.4) 2.5) 2.2 Rocks 2.6) 2.2.1 Types: igneous rocks, sedimentary rocks and metamorphic rocks 2.7) 2.2.2 Formation, determination and its effects to the soils	
3. 3.0 Factors and processes of soil formation 3.1) 3.1 Factors of soil formation: parent materials, climate, biota, topography and time 3.2) 3.2 Processes of soil formation: dissolution, hydrolysis, hydration, carbonization, oxidation, reduction, elevation, illuviation, podzolization, leaching, salination, decomposition and synthesis	
4. 4.0 Physical properties of soil 4.1) 4.1 Colour and texture 4.2) 4.2 Structure and consistency 4.3) 4.3 Particle and bulk density of soil 4.4) 4.4 Soil air: porosity	

5. 5.0 Soil water 5.1) 5.1 Functions of soil water 5.2) 5.2 Water holding capacity 5.3) 5.3 Soil water conditions: saturation, field capacity, wilting coefficient, hygroscopic point. Types of water: available water and unavailable water 5.4) 5.4 Measuring soil moisture content: gravimetric, potentiometer, electrical resistant block and neutron probe 5.5) 5.5 Water movement in soils: saturated flow, unsaturated flow and vapor movement
6. 6.0 Soil temperature 6.1) 6.1 Importance of temperature on soils 6.2) 6.2 Sources of temperature 6.3) 6.3 Temperature and its relation to plant growth and soil organisms 6.4) 6.4 Control of soil temperature
7. 7.0 Chemical properties of soil 7.1) 7.1 Soil colloidal chemistry 7.2) 7.1.1 Types of clay minerals 7.3) 7.1.2 Sources of charges on clay minerals 7.4) 7.5) 7.2 Cation exchange (CE) 7.6) 7.2.1 Concept and definition and factors influencing CE 7.7) 7.2.2 Factors influencing CE, cation exchange capacity (CEC) and base saturation (BS) 7.8) 7.2.3 Calculation based on CEC and BS 7.9) 7.10) 7.3 Soil pH 7.11) 7.3.1 Types of acidity and alkalinity 7.12) 7.3.2 Effects of pH on nutrients availability and soil organisms 7.13) 7.3.3 Factors affecting soil pH: leaching, organic matter, fertilizers, atmosphere, oxidation of pyrite and hydrolysis of aluminum 7.14) 7.15) 7.4 Lime requirement 7.16) 7.4.1 Liming materials 7.17) 7.4.2 Effect of liming and over liming on soils 7.18) 7.4.3 Methods of liming 7.19) 7.4.4 Calculation: estimating quantities of lime required by a soil 7.20) 7.21) 7.5 Plant nutrients 7.22) 7.5.1 Sources of plant nutrients 7.23) 7.5.2 Macronutrients and micronutrients 7.24) 7.5.3 Functions and deficiency symptoms of nutrients 7.25) 7.5.4 Availability and complex form of nutrients 7.26) 7.5.5 Nutrient uptake by plant: root interception, mass flow and diffusion.
8. 8.0 Soil biological characteristics 8.1) 8.1 Soil macro-organisms and micro-organisms 8.2) 8.2 Role of organisms in enhancing soil fertility 8.3) 8.3 Factors affecting soil organisms 8.4) 8.4 Practices that improves soil organisms' activity 8.5) 8.5 Humus and soil organic matter (SOM)
9. Laboratory 1: Soil sampling and sample preparation 9.1) n/a
10. Laboratory 2: Introduction to minerals in soil 10.1) n/a
11. Laboratory 3: Introduction to rocks in soil 11.1) n/a
12. Laboratory 4: Weathering of minerals and rocks 12.1) n/a
13. Laboratory 5: Determination of soil colour 13.1) n/a
14. Laboratory 6: Soil particle size analysis (texture) 14.1) n/a
15. Laboratory 7: Determination of soil particle density and bulk density 15.1) n/a
16. Laboratory 8: Determination of soil water 16.1) n/a
17. Laboratory 9: Determination of soil pH 17.1) n/a
18. Laboratory 10: Determination of soil lime requirement 18.1) n/a

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Case Study	Chapter 1 until chapter 8	20%	CLO3
	Online Quiz	Chapter 1 until chapter 8	20%	CLO1
	Written Report	Problem based assessment in the laboratory	20%	CLO2

Reading List	Recommended Text	• Brady, N. C. and Weil, R. R. 2007, <i>The Nature and Properties of Soils</i> , 14th ed. Ed., Prentice Hall New Jersey, USA [ISBN: 978-013227938]
	Reference Book Resources	<ul style="list-style-type: none"> • Ashman, M. and Puri, G. 2002, <i>Essential Soil Science</i>, Blackwell publishing MA, USA [ISBN: 978-063204885] • Carter, M. R. and Gregorich, E. G. 2007, <i>Soil Sampling and Methods of Analysis</i>, 2nd ed. Ed., CRC Press [ISBN: 000-084933586] • Coyne, M. S. and Thompson, J. A. 2005, <i>Fundamental of Soil Science</i>, Delmar Cengage Learning [ISBN: 978-076684266] • Foth, H. D. 1984, <i>Fundamentals of Soil Science</i>, 7th ed. Ed., Wiley [ISBN: 978-047188926] • Jones, J.B. 2001, <i>Laboratory Guide Conducting Soil Tests and Plant Analysis</i>, CRC Press Ltd. [ISBN: 978-084930357] • Miller, R. W. and Gardiner, D. T. 2007, <i>Soils in Our Environment</i>, 11th ed. Ed., Prentice Hall [ISBN: 978-013219104] • Plaster, E. 2013, <i>Soil Science and Management</i>, 6th ed. Ed., Delmar Cengage Learning New York, USA [ISBN: 978-084002432]
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	