



Term Final Examination
Soil, Water and Environment Discipline, Khulna University

Year: **Second** Term: **First** Examination Year: **2026** Session: **2024-2025**
Course Code: **0888 13 SWE 2111** Course Title: **Soil Mineralogy**
Total Marks: **60** Time: **03 hours** Credit: **3.0**

Instructions :

- * The figures in the right margin indicate full marks. The questions are of equal value.
- * Use separate answer script for each section.

Section A

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	Why do layer silicate minerals exhibit colloidal properties? Discuss with examples. [L4, CLO1]	3
b)	We could predict CEC from isomorphous substitution- do you agree or disagree? Justify your answer. [L 5, CLO 2]	4
c)	Soil fertility is an outcome of CEC but not soil productivity- justify it in terms of 2:1 layer silicate minerals. [L 4, CLO 2]	3
2. a)	Describe the nomenclature system of layer silicate minerals. [L2, CLO 1]	5
b)	To what extent smectite differ from vermiculite and why? [L3, CLO 1]	3
c)	Write the properties of kaolinite and its occurrence in soil. [L2, CLO 1]	2
3.	$[\text{Si}_{7.5}\text{Al}_{0.5}]^{\text{IV}}[\text{Fe}_{2.0}^{3+}\text{Al}_{1.0}\text{Fe}_{0.2}^{2+}\text{Mg}_{1.0}]^{\text{VI}}\text{O}_{20}(\text{OH})_4\text{K}_{1.1}$ - from this given formula:	
a)	Construct the structural diagram on the b-c plane. [L3, CLO 1]	5
b)	Calculate the charge distribution of the layer. [L6, CLO 1]	3
c)	Describe the formation process and properties of the given formula. [L2, CLO 1]	2
4.	Write short notes on the followings: [L2, CLO 1]	2.5 x 4 = 10
a)	Formation of hexagonal cavity	b) Dioctahedral Mica
c)	Charge development in layer silicate minerals	d) Properties and occurrence of trioctahedral vermiculite

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Section B

There are 04 (four) questions in this section. Answer any 03 (three) questions.

Q. No.	Question Description	Marks
1. a)	Demonstrate the importance of soil mineralogy in the context of engineering applications and environmental management. [L2, CLO1]	3
b)	Explain the relationship between the structural linkage of silica tetrahedral (SiO_4) and the overall stability of silicate minerals. [L2, CLO1]	4
c)	Using the Goldich-style weathering sequence, explain why Olivine is significantly more susceptible to chemical weathering than Quartz. [L2, CLO2]	3
2. a)	Summarize the concept of interstratification in layer silicates and provide examples of regular versus random stratification. [L2, CLO2]	4
b)	Differentiate between chlorite and hydroxy-interlayered minerals. [L4, CLO2]	3
c)	Illustrate the weathering sequence of chlorite minerals and the resulting formation of hydroxy-interlayered minerals (HIV and HIS). [L3, CLO2]	3
3. a)	Explain how Bragg's Law is used to identify mineral types. [L2, CLO3]	3
b)	Apply XRD principles to interpret a clay sample's diffractogram showing basal reflections at 14.2 Å (expanding to 17.8 Å with glycerol) and 10 Å. Identify the dominant mineral(s) and justify based on spacing shifts. [L3, CLO3]	3
c)	Interpret how kaolinite and chlorite can appear similar in some XRD patterns and explain the steps you would take to differentiate them confidently. [L2, CLO3]	4
4. a)	Illustrate the strengths and limitations of FTIR for identifying clay mineral groups. [L2, CLO3]	5
b)	A sample shows 10 Å XRD peak sharpening after Li-saturation and heating (to 1.0 Å shrinkage). Analyze if this confirms illite versus mica, discussing structural charge differences. [L4, CLO3]	5



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Year: **Second** Term: **First** Examination Year: **2026** Session: **2024-2025**
Course Code: **0888 13 SWE 2113** Course Title: **Surface Chemistry**
Total Marks: **60** Time: **03 hours** Credit: **3.0**

Instructions :

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- * Use separate answer script for each section.

Section A

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	Diagrammatically show the composition of solution, colloid and suspension. [L1, CLO1]	3
b)	Define with example: I) Emulsion, II) Aerosol and III) Fibrillar deform system. [L1, CLO1]	3
c)	Classify colloids on the types of particles of the dispersed phase. [L2, CLO1]	4
2. a)	"Charges on protein sols alters with medium pH". Explain [L2, CLO1]	3
b)	Explain an electrophoresis system that determines the charge of the sol particles. [L2, CLO1]	3
c)	Illustrate the Bredig's arc method to prepare colloids. [L2, CLO1]	4
3. a)	"Inner sphere complexes are not easily reversible". Explain. [L2, CLO1]	3
b)	Develop an electrodialysis system to purify colloids. [L3, CLO1]	4
c)	"Composition of soil colloids greatly influence soil behavior"- explain. [L2, CLO1]	3
4.	Write short notes on the followings: [L2, CLO1]	2.5 x 4 = 10
a)	Hydrated cations	
b)	Hardy Schulze rule	
c)	Colligative property of colloids	
d)	High activity clay	

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Section B

There are 04 (four) questions in this section. Answer any 03 (three) questions.

Q. No.	Question Description	Marks
1. a)	Define adsorption and absorption. [L1, CLO1]	2
b)	Distinguish between physical and chemical adsorption. [L4, CLO3]	3
c)	Explain the effect of temperature and pressure on the adsorption process. [L2, CLO3]	5
2. a)	Define adsorption isotherm. [L1, CLO1]	2
b)	Explain the forces affecting adsorption phenomena. [L2, CLO3]	8
3. a)	What is the basic structure of the electrical double layer in soil, and how is it formed? [L2, CLO2]	3
b)	How do cations in the diffuse layer affect soil's cation exchange capacity (CEC)? [L2, CLO2]	3
c)	Explain the Stern double layer theory with suitable diagram. [L2, CLO2]	4
4.	Write short notes on the followings: [L3, CLO3]	2.5 x 4 = 10
a)	Legand exchange	b) Positive heat of adsorption
c)	$S = k_d C^n$ and $x/m = kc^{1/n}$	d) Adsorption of water



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Year: **Second** Term: **First** Examination Year: **2026** Session: **2024-2025**
Course Code: **0888 13 SWE 2121** Course Title: **Water and Soil Pollution**
Total Marks: **60** Time: **03 hours** Credit: **3.0**

Instructions :

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- * Use separate answer script for each section.

Section A

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	list the signs of polluted water. [L 1; CLO 1]	2
b)	How can water pollution be controlled by using technical methods and enforcing legislation? -Narrate. [L 4; CLO 1]	4
c)	Discuss the effect of water pollution on environment. [L 6; CLO 1]	4
2. a)	What do you mean by eutrophication? [L 1; CLO 1]	2
b)	Give your suggestions for controlling eutrophication. Justify your suggestions. [L 5; CLO 1]	3
c)	Narrate the conversion process of an oligotrophic lake to a eutrophic lake with figures. [L 3; CLO 1]	5
3. a)	What are the reasons of groundwater pollution in Bangladesh? [L 2; CLO 2]	3
b)	How could pathogens be removed from polluted water? [L 2; CLO 4]	3
c)	Describe the effect of radioactive waste in water pollution on the environment. [L 3; CLO 4]	4
4. a)	What do you know about Minamata disease? [L 1; CLO 2]	3
b)	Explain the effects of pesticides on water pollution. [L 5; CLO 2]	4
c)	Describe the effect of Arsenic on human health. [L 3; CLO 2]	3

(Please Turn Over)



Section B

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	Define soil pollution. [L 1; CLO 3]	1
b)	Categorize the major causes of soil pollution in context of Bangladesh. [L 2; CLO 3]	3
c)	Discuss the negative consequences of soil pollution. [L 4; CLO 3]	3
d)	Describe the process of controlling soil pollution. [L 5; CLO 3]	3
2. a)	Why do heavy metals become contaminant in the environment? [L 2; CLO 3]	2
b)	“Soil contaminated by heavy metals is the result of human activity” – Justify this statement. [L 5; CLO 3]	4
c)	Describe remediation technologies for heavy metal contaminated soil. [L 3; CLO 3]	4
3. a)	What is bioremediation? Why is it often used for cleaning up soil and groundwater? [L 2; CLO 4]	3
b)	Narrate the techniques of in-situ bioremediation. [L 2; CLO 4]	3
c)	Discuss the efficacy of phytoremediation as a strategy for contaminated soil recovery. [L 4; CLO 4]	4
4. a)	What is biochar? Write down the process of biochar production. [L 2; CLO 4]	3
b)	Explain the impact of biochar as a sorbent of pesticides. [L 4; CLO 4]	3
c)	Evaluate the potential of biochar as a sustainable solution for contemporary agricultural limitations. [L 2; CLO 2]	4



Term Final Examination
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Year: Second	Term: First	Examination Year: 2026	Session: 2024-2025
Course Code: 0888 13 SWE 2131	Course Title: Environmental Chemistry		
Total Marks: 60	Time: 03 hours	Credit: 3.0	

Instructions :

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- * Use separate answer script for each section.

Section A

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	Draw a labeled diagram of atmospheric layers and explain their environmental significance. [L 3; CLO 1]	3
b)	Describe the chemical composition of the atmosphere. [L 3; CLO 1]	2
c)	Differentiate among the crust, mantle, and core based on composition and properties. [L 4; CLO 3]	5
2. a)	Distinguish between contamination and pollution. [L 2; CLO 2]	3
b)	Describe the sources, significance, and tolerable limits of major trace elements in soil and water. [L 2; CLO 2]	4
c)	Analyze the causes of air pollution in Khulna city and suggest appropriate control measures. [L 4, CLO 1]	3
3. a)	Explain the atmospheric reactions responsible for nitric acid and sulfuric acid formation. [L 2; CLO 2]	3
b)	How does acid rain affect soil and water systems? [L 3, CLO 2]	3
c)	Analyze the relationship between industrial waste and water pollution. [L 4; CLO 2]	4
4. a)	Discuss the impact of lead and cadmium poisoning on human body. [L 4; CLO 2]	6
b)	Outline the mechanism of ozone layer depletion. [L 2, CLO 1]	4

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Section B

There are 04 (four) questions in this section. Answer any 03 (three) questions.

Q. No.	Question Description	Marks
1. a)	Illustrate how rising CO ₂ levels influence global temperature changes. [L3, CLO2]	4
b)	Assess the severity of socio-economic impact of global climate change. [L5, CLO2]	4
c)	Apply your knowledge to suggest suitable adaptation strategies for reducing climate-induced hazards in coastal regions of Bangladesh. [L3, CLO2]	2
2. a)	Differentiate between fossil fuels and biofuels. [L4, CLO2]	2
b)	Evaluate the role of biofuels in sustainable energy development. [L5, CLO2]	2
c)	Narrate the four major characteristics of hazardous wastes. [L2, CLO3]	4
d)	State thermal treatment technology to treat hazardous waste materials in the environment. [L2, CLO3]	2
3. a)	Analyze the transport mechanisms of pollutants through soil. [L4, CLO3]	3
b)	Explain why heavy metals are toxic to human health. [L2, CLO1]	2
c)	Illustrate the formation of arsenic pyrites in groundwater. [L3, CLO1]	3
d)	Demonstrate how organic amendments affect the bioavailability of cadmium (Cd) in soil. [L3, CLO1]	2
4. a)	Define green chemistry. State the principles of green chemistry. [L1, CLO3]	5
b)	Analyze whether commercial synthesis or green synthesis is more preferable for acetaldehyde production. [L4, CLO3]	5



Term Final Examination
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Year: Second	Term: First	Examination Year: 2026	Session: 2024-2025
Course Code: 0511 13 Mbio 2153	Course Title: Fundamentals of Microbiology		
Total Marks: 60	Time: 03 hours	Credit: 3.0	

Instructions :

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- * Use separate answer script for each section.

Section A

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	Analyze the origin of life on Earth on scientific basis. [L4, CLO1]	4
b)	Describe a polytypic organism. [L2, CLO1]	3
c)	Explain moist heat as a method of sterilization. [L2, CLO1]	3
2. a)	Diagrammatically illustrate the life cycle of actinomycetes. [L2, CLO2]	3
b)	Summarize the major characteristics of fungi. [L2, CLO2]	3
c)	Outline the classification schemes of algae. [L2, CLO2]	4
3. a)	Draw and label the various components of a <i>Euglena</i> cell. [L2, CLO2]	3
b)	Explain the "Baltimore classification of viruses". [L4, CLO2]	3
c)	Describe the various aspects of eubacteria. [L4, CLO2]	4
4.	Write short notes on the followings: [L2, CLO2]	2.5 x 4 = 10
a)	Limitation of creation theory	
b)	Mutation	
c)	Chemoheterotrophs	
d)	Prokaryotic and eukaryotic cell	

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Section B

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	Define the following terms: Selective media, Mutualism. [L1; CLO3]	2
b)	Compare streak plate and pour plate culture. [L4, CLO3]	4
c)	What is stain? Mention the chemical composition of stain. [L1; CLO3]	4
2. a)	Define generation time. [L1; CLO3]	1
b)	Describe the dynamics of bacterial growth in nature. [L6; CLO3]	4
c)	Classify and describe bacteria based on the O ₂ requirement. [L4; CLO3]	5
3. a)	Illustrate the principle to determine the size of a specimen under microscope. [L2, CLO3]	3
b)	Describe the principle of an electron microscope. [L6; CLO3]	4
c)	What are the applications of an electron microscope? [L1; CLO3]	3
4. a)	What is primer? [L1; CLO3]	2
b)	Write down the principal of RT-PCR? [L1; CLO3]	3
c)	Explain the biochemical procedure of <i>Rhizobium</i> identification. [L2; CLO3]	5



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Year: **Second** Term: **First** Examination Year: **2026** Session: **2024-2025**
Course Code: **0311 13 Econ 2155** Course Title: **Principles of Economics**
Total Marks: **60** Time: **03 hours** Credit: **3.0**

Instructions :

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- * Use separate answer script for each section.

Section A

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	Define economics and agricultural economics. [L 1; CLO 1]	3
b)	Write down your idea about: [L 1; CLO 1] i) Scarcity ii) Commodity iii) Distribution iv) Consumption	7
2. a)	Explain production possibility curve (PPC) graphically. [L 2; CLO 1]	6
b)	Write short note on opportunity cost. [L 2; CLO 1]	4
3. a)	What is returns to scale? [L 2; CLO 2]	3
b)	How producer's equilibrium attained with iso-quant and iso-cost curve. [L 3; CLO 2]	7
4. a)	Distinguish short run and long run production function. [L 4; CLO 2]	2
b)	Explain the three stages of law of variable proportion with figure. [L 2; CLO 2]	5
c)	List the characteristics of monopoly market. [L 1; CLO 2]	3

(Please Turn Over)



Section B

There are **04 (four)** questions in this section. Answer any **03 (three)** questions.

Q. No.	Question Description	Marks
1. a)	Write short note on overview of the Economy of Bangladesh. [L 3; CLO 3]	5
b)	Discuss the major sources and types of agricultural credit in Bangladesh. [L 6; CLO 3]	5
2. a)	What is agricultural finance? [L 1; CLO 3]	2
b)	Discuss the role of agricultural finance for agricultural development. [L4 ; CLO 3]	8
3. a)	What is Land Reform? [L 1; CLO 3]	3
b)	Describe about merits and demerits of Land Reform. [L 4; CLO 3]	7
4. a)	What is agricultural marketing? [L 1; CLO 4]	2
b)	What are the important threats of agricultural marketing in Bangladesh? How can we overcome the threats? [L 5; CLO 4]	8