

Soil, Water and Environment Discipline, Khulna University
4th Year 1st Term Examination 2024-25
Course no: 0888 13 SWE 4111, Course Title: Soil Survey and Land Evaluation
Full marks-60 Time-3 hours

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

Section-A (There are four questions in this section. Answer any three questions)

1. a) What is soil survey? Write down the scopes of soil survey. [L2, CLO1] 1+2=3
 b) Outline the uses of remote sensing in soil survey. [L4, CLO2] 3
 c) Evaluate the role of soil survey data in sustainable land management and planning. [L5, CLO1] 4

2. a) How can you make the travers line and open pits for the soil survey? [L3, CLO1] 3
 b) What are the functions of detailed soil survey? [L2, CLO1] 3
 c) Write down the steps of soil survey. [L2, CLO1] 4

3. a) What is stereoscopic vision? [L1, CLO2] 2
 b) Explain the roles of aerial photograph in soil survey. [LPP4, CLO2] 4
 c) Write down the uses of photomaps and topographic map. [L3, CLO2] 2+2=4

4. a) What is band combination? [L1, CLO2] 2
 b) Differentiate between conventional field surveys techniques and remote sensing techniques used in soil survey. [L3, CLO2] 2+2=4
 c) Briefly outline the steps followed in soil series identification. [L3, CLO2] 4

Section-B (There are four questions in this section. Answer any three questions)

5. a) Differentiate between land use and land cover with suitable examples. [L2, CLO4] 3
 b) Demonstrate the importance of land use planning in Bangladesh. [L3, CLO4] 3
 c) Evaluate sustainable land use practices for environmental protection and food security. [L5, CLO4] 4

6. a) What are the bases of land capability classification? [L1, CLO4] 2
 b) Which land capability classes are suitable for common agricultural crops in Bangladesh? Analyze the characteristics and limitations of these classes. [L3&4, CLO4] 1+7

7. a) Define land evaluation and explain its objectives. [L2, CLO4] 1+2
 b) Illustrate the major steps involved in the land evaluation procedure. [L3, CLO4] 4
 c) Explain how land qualities are selected for land evaluation. [L3, CLO4] 3

8. a) Differentiate between taxonomic units and mapping units in soil survey. [L3, CLO3] 2
 b) Classify the different kinds of map units used in soil resource inventories and explain their major features. [L3, CLO3] 4
 c) Analyze the items that need to be described during soil examination. [L4, CLO3] 4



Khulna University

Soil, Water and Environment Discipline

Fourth Year First Term; Session: 2024-2025

Course Title: Environmental Soil Mechanics; Course No: 0888 13 SWE 4113

Full Marks: 60; Time: 03 Hours; Credit Hours: 03

* The figures in the margin indicate full marks. The questions are of equal value.

* Use separate sheet for each section.

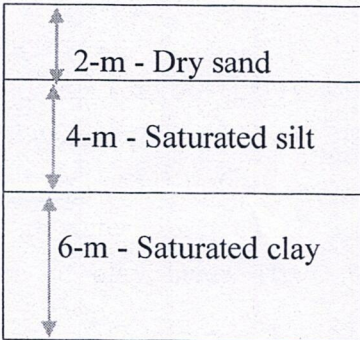
* Special instructions (if any): Parts of each question must be answered consecutively.

Section-A

Marks

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

1.
 - a) Define the following term: shearing stress, longitudinal strain, fragipans, claypan. [L1; CLO1] 02
 - b) How would you control soil compaction? [L1; CLO1] 03
 - c) Explain the behavior of soil bulk density with variable moisture content under a constant compactive effort. [L2; CLO1] 03
 - d) The bulk density of a soil is given 1.25 g.cm^3 . Find out the void-ratio of that soil. [L1; CLO1] 02
2.
 - a) Describe the soil classification systems for engineering purposes. [L6; CLO1] 04
 - b) Which index properties of coarse-grained soil are used for engineering purposes? [L1; CLO1] 03
 - c) Explain the consistency as an index properties of fine grain soil for engineering purposes. [L2; CLO1] 03
3.
 - a) Draw and explain typical stress-strain curves. [L6; CLO1] 03
 - b) Characterize the Bossinesq's equation with assumptions. [L1; CLO1] 04
 - c) A concentrated load of 22.5 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 15 meters and (i) directly under the load, and (ii) at a horizontal distance of 7.5 meters. [L1; CLO1] 03
4.
 - a) What is shear stress? Characterize Terzaghi's one-dimensional consolidation theory. [L1; CLO2] 03
 - b)



In three soil layer, unit weights are: dry sand = 18 kN/m^3 , saturated silt = 22 kN/m^3 , saturated clay = 25 kN/m^3 , unit weight of water is 9.81 kN/m^3 , calculate the total vertical stress at the bottom of the saturated clay layer, pore water pressure, and effective stress at bottom of clay layer. [L6; CLO2]

 04
 - c) What is virgin compression curve? Draw a curve between voids ratio and effective pressure. [L1; CLO2] 03

Section B**Marks**

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

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|-------|---|-------|
| 5. a) | What is meant by shear strength of soil? Mention the factors affecting soil shear strength. [L1; CLO1] | 1+2=3 |
| b) | Evaluate the influence of soil water content on shear strength under dry, unsaturated, and saturated conditions. [L5; CLO1] | 03 |
| c) | Critically discuss the limitations of the Mohr–Coulomb theory. [L5; CLO1] | 04 |
| 6. a) | What is thixotropy in soils? [L1; CLO3] | 01 |
| b) | Compare the consolidation behavior of coarse-grained and fine-grained soils. [L4; CLO3] | 04 |
| c) | Evaluate the factors affecting soil compressibility with reference to soil type, stress history, and moisture content. [L5; CLO3] | 05 |
| 7. a) | Define the factor of safety in slope stability analysis. [L1; CLO3,4,5] | 01 |
| b) | Derive and explain the Fellenius method equation for $\phi_u = 0$ saturated clay slopes. [L5; CLO3,4,5] | 05 |
| c) | Discuss various mechanical measures used for improving slope stability in environmental and geotechnical engineering projects. [L4; CLO3,4,5] | 04 |
| 8. a) | Define soil puddling. [L1; CLO6] | 02 |
| b) | State the mechanism of soil puddling. [L2; CLO6] | 02 |
| c) | How does puddling in paddy field influence thermal conductivity, diffusivity, non-capillary pore space? [L1; CLO6] | 04 |
| d) | Describe the management practices involve in puddling for lowland rice cultivation. [L2; CLO6] | 02 |

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Section-A

There are 4 questions in this section. Answer any 3 questions

	Marks
1. a) Distinguish between submerged and waterlogged soil. (L1, CLO2)	2
b) Schematically describe the key layers in a paddy soil profile. (L2, CLO1)	4
c) Why does soil pH in submerged conditions shift toward neutral? Explain its relationship with reduction processes. (L2, CLO2)	4
2. a) During submergence, why sulfate reduces after nitrate as sulfate contains more oxygen than nitrate? Give thermodynamic explanation. (L2, CLO1)	2
b) Why do microbes reduce carbon ($\text{CO}_2 \rightarrow \text{CH}_4$) when ΔG is near zero? (L2, CLO2)	2
c) If organic matter (e.g., rice straw) is added, how does the redox status of submerged soil change? (L1, CLO1)	3
d) What are the practical implications of adding organic matter in paddy soils? (L3, CLO1)	3
3. a) Why is Eh considered the best available measure of soil reduction? (L1, CLO1)	3
b) Describe the major biogeochemical processes that start as a result of submergence. (L3, CLO2)	3
c) Diagrammatically show the relationship between pe and pH. (L3, CLO2)	2
d) How does soil EC change with submergence? (L2, CLO2)	2
4. a) What kind of redox gradient is created in the rhizosphere? (L1, CLO3)	2
b) Write the thermodynamic sequence of sequential reduction in submerged soil and mention the electron acceptor involved in each step. (L3, CLO3)	4
c) Describe the relation between pe and concentration of redox couple. (L2, CLO3)	4

Section-B

(There are 4 questions in this section. Answer any 3 questions)

		Marks
5.	<p>a) Explain why phosphorus availability typically decreases when a previously submerged soil begins to dry? [L2, CLO3]</p> <p>b) Describe the transformation of N in a submersed soil. [L1, CLO3]</p> <p>c) Explain the competition between denitrification and DNRA in submerged soils. [L2, CLO3]</p>	<p>2</p> <p>3</p> <p>5</p>
6.	<p>a) Explain the effect of submergence on phosphorus solubility. [L2, CLO4]</p> <p>b) Describe the three main pathways of CH₄ production in submerged soils. [L3, CLO3]</p> <p>c) Using the concept of oxygen zonation in submerged soils, describe the three main zones and relate each zone to methanogenesis and methanotrophy. [L3, CLO3]</p>	<p>3</p> <p>3</p> <p>4</p>
7.	<p>a) How do rice plants adapt under submerged soil conditions? [L2, CLO3]</p> <p>b) You are managing a coastal, periodically waterlogged rice field prone to both Fe toxicity and P fixation after drainage. Recommend a combined water-management and liming strategy to balance: avoiding extreme reduction, avoiding extreme oxidation and limiting CH₄ emissions. [L5, CLO3]</p>	<p>3</p> <p>7</p>
8.	<p>a) How does alternate wetting and drying (AWD) affect organic matter decomposition rates? [L2, CLO3]</p> <p>b) Justify why ammonium accumulation is considered a fundamental difference between aerobic and anaerobic nitrogen cycling. [L4, CLO3]</p> <p>c) Critique the statement: "Flooding is primarily a destructive force for soil health," using evidence of microbial resurgence and nutrient cycling. [L5, CLO3]</p>	<p>2</p> <p>3</p> <p>5</p>

Levels of Bloom's Cognitive Domain:

[L1=Remember; L2=Understand; L3=Apply; L4=Analyze; L5=Evaluate; L6=Create

Khulna University

School: Life Science Discipline: Soil, Water and Environment Program: B.S. (Hons)
Year: 4th Term: 1 Examination Year: 2026 Session: 2024-25
Course Code: 0888 13 SWE 4121 Course Title: Water and Wastewater Treatment
Total Marks: 60 Time: 3 Hours Credit: 3.0

Instructions (if any)

- The figures in the margin indicate full marks. The questions are of equal value.
- Use a separate sheet for each section.
- Special instructions: Parts of each question must be answered consecutively.

Section A

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

Q. No.	Question Description	Marks
1(a)	What is WARPO? [L1; CLO1]	01
1(b)	Classify lakes based on the nutritional status of lakes. [L4; CLO1]	02
1(c)	Examine how the thermal cycle influences the physical and biological characteristics of lakes. [L4; CLO1]	04
1(d)	Apply your understanding of environmental pollution to explain how acid rain and climate change affect water quality. [L3; CLO2]	03
2(a)	What is water table? [L1; CLO2]	01
2(b)	Differentiate between surface and groundwater. [L3; CLO2]	04
2(c)	Analyze the role of watershed management in poverty alleviation and rural development by examining how watershed interventions influence resource conservation, agricultural productivity, employment generation, and socio-economic improvement in rural areas. [L4; CLO2]	05
3(a)	What is eutrophication? [L1; CLO2]	02
3(b)	Identify the causes of eutrophication and discuss mitigation measures. [L3; CLO2]	04
3(c)	Compare the WHO guidelines and Bangladesh standards for drinking water quality, and why do the standards differ for Arsenic? [L5; CLO2]	04
4(a)	Define heavy metals. [L1; CLO2]	02
4(b)	Describe the biochemical effects of lead and cadmium on human beings. [L3; CLO2]	04
4(c)	Apply the principles of water resource management to explain the major aspects of water management in Bangladesh and their role in sustainable water use. [L3; CLO2]	04

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Khulna University

School: Life Science

Discipline: Soil, Water and Environment

Program: B.S. (Hons)

Year: 4th

Term: 1

Examination Year: 2026

Session: 2024-25

Course Code: 0888 13 SWE 4121

Course Title: Water and Wastewater Treatment

Total Marks: 60

Time: 3 Hours

Credit: 3.0

Instructions (if any)

- The figures in the margin indicate full marks. The questions are of equal value.
- Use a separate sheet for each section.
- Special instructions: Parts of each question must be answered consecutively.

Section B

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

Q. No.	Question Description	Marks
5(a)	How do treating water and wastewater help us? [L2; CLO3]	02
5(b)	Explain the different types of wastewater treatment plant. [L2; CLO3]	03
5(c)	Draw and describe the common anaerobic reactors. [L3; CLO3]	05
6(a)	What are the key types of advanced oxidation processes? [L1; CLO3]	02
6(b)	Compare the design, mechanism and operation of aerated lagoons and oxidation ponds. [L4; CLO3]	03
6(c)	Breakdown the mechanism of reverse osmosis process with appropriate figures. [L4; CLO3]	05
7(a)	Why is continuous pumping of dissolved oxygen critical to the performance of an activated sludge system during secondary treatment? [L3; CLO2]	05
7(b)	Analyze how a massive industrial spill of toxic, non-biodegradable synthetic pesticides would impact the biological treatment efficiency of an activated sludge system versus an advanced oxidation process. [L4; CLO2]	05
8(a)	Distinguish between SRT and HRT. [L2; CLO3]	02
8(b)	Classify planned wastewater reuse and make a list of the sectors where wastewater can be reused. [L3; CLO4]	04
8(c)	Evaluate the methods of water removal from sludge and sludge disposal. [L6; CLO4]	04

Levels of Bloom's cognitive domain:

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Khulna University

School: Life Science Discipline: Soil, Water and Environment Program: MS
 Year: 1st Term: 1st Examination Year: 2026 Session: 2025-2026
 Course Code: 0888 13 SWE 5101 Course Title: Soil Geomorphology
 Total Marks: 60 Time: 3 Hours Credit: 3.0
 Instructions (if any): Parts of each question must be answered consecutively
 Comments/Remarks (if any):

Section A

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

Marks

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|-------|--|--------------|
| 1 (a) | What is soil geomorphology, and how does it differ from classical pedology? [L2; CLO1] | 02 |
| 1(b) | Describe Jenny's state factor model and its application to landscape evolution. [L2; CLO1] | 04 |
| 1 (c) | Explain the role of geomorphic processes in controlling soil variability. [L4; CLO1] | 04 |
| 2 (a) | Define denudation and explain its geomorphic significance [L2; CLO2] | 01+02
=03 |
| 2 (b) | Explain how soils function as open systems in terms of matter and energy exchange. [L4; CLO2] | 03 |
| 2 (c) | Illustrate how energy gradients influence soil erosion and sediment redistribution. [L4; CLO2] | 04 |
| 3 (a) | Define the catena concept in soil geomorphology. [L1; CLO1] | 01 |
| 3 (b) | Differentiate between derivation slopes and wash slopes in relation to the Aufbereitung concept. [L4; CLO2] | 04 |
| 3 (c) | Evaluate the usefulness of the catena concept in modern soil survey and land management. [L5; CLO2] | 05 |
| 4 (a) | Describe the characteristics of soils on stepped landscapes and explain how differential erosion and stability across steps lead to variations in soil age, depth and horizonation. [L2; CLO4] | 02+03
=05 |
| 4 (b) | Explain how fluvial processes create soil stratigraphic records in river valleys. [L4; CLO3] | 03 |
| 4 (c) | Compare soil development on active floodplains with that on older alluvial terraces. [L5; CLO3] | 02 |

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