

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Civil Engineering



Study Programme	: Bachelor of Sciences Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: CVX6345 Environmental Engineering
Academic Year	: 2024/2025
Date	: 29 th January 2026
Time	: 1330-1630hrs
Duration	: 03 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **SIX (06)** questions on **Two (02)** pages.
3. Answer **ANY FIVE** questions
4. Answer for each question should commence from a new page.
5. Necessary additional information is provided.
6. This is a Closed Book Test (CBT).
7. Answers should be in clear handwriting.
8. Do not use Red colour pen.

Question 1

Nutrient loading, especially nitrate (NO_3^-) and phosphate (PO_4^{3-}) via point and non-point sources, is one of the serious issues of aquatic ecosystems.

- a) Define the terms "Point Source" and Non-point Sources," considering nutrient loading (6 Marks)
- b) Provide three examples for each category (6 Marks)
- c) Briefly describe environmental consequences of excess nutrient loading (8 Marks)

Question 2

"The impacts of global environmental issues have gradually increased over the past few decades leading to significant economic, ecological, and social consequences". Justify this statement providing suitable examples. (20 marks)

Question 3

- a) Explain briefly the adverse effects of noise pollution on both the environment and human health. (4 Marks)
- b) Briefly explain the concept of root mean square pressure which is used in noise measurement (4 Marks)
- c) Using the definition of sound pressure level, derive the equation utilized to estimate the average sound pressure level when combining multiple sound pressure levels. (8 marks)

$$\bar{L}_p = 20 \log \left[\frac{1}{N} \sum_{j=1}^N 10^{\frac{L_j}{20}} \right]$$

Where;

$\bar{L}_p$: Average sound pressure level(dB) with a reference level of $20\mu\text{Pa}$

L_j : j^{th} sound pressure level, (dB) with a reference level of $20\mu\text{Pa}$

N: Number of sound pressure levels

- d) Multiple appliances are operating simultaneously within a house, resulting in the following sound levels at a study table. Determine the average sound pressure level experienced at the study table due to these sounds. (4 Marks)

Washing machine: 72dB

Blender; 76 dB

Television: 68 dB

Question 4

- a) Provide a concise explanation of how air pollution harms both humans and the environment. (6 Marks)
- b) If one mole of an ideal gas pollutant occupies a volume of 22.414L at 0°C and 101.325 kPa, develop an equation to determine the volume (V_p) of an ideal gas (with mass M_p) at temperature T_2 and pressure P_2 , given its Granular Molecular Weight (GMW). The ideal gas equation can be utilized for this calculation. (10 Marks)
- c) Determine the ideal gas concentration provided in question 4(b) in parts per million (ppm). Also, derive an expression for this gas concentration in ppm utilizing the terms introduced in that question, considering the volume of the gas container as V_a . (4 Marks)

Question 5

- a) In water treatment, coarse screens are used as pretreatment. Briefly explain the procedure of coarse screening in water treatment process. (5 Marks)
- b) With the aid of an appropriate sketch briefly explain the use of Void Space Ratio (VSR) in designing coarse screens. (5 Marks)
- c) An initial design for a coarse screen is needed to accommodate an approach flow velocity of 0.4 m/s. Verify whether the given set of data is suitable for this design requirement.
 Bar spacing: 75 mm
 Bar thickness: 15 mm
 Maximum allowable head loss: 150 mm
 Angle of slope from the vertical is 30°
 Design flow rate: 0.4 m³/s
 Head loss through screen (h) = $\frac{V_b^2 - V_a^2}{2g} \times \frac{1}{0.7}$
 V_b : Velocity through screen
 V_a : Approach velocity
 g : Gravitational acceleration (10 Marks)

Question 6

- a) Briefly describe the utilization of aeration in water treatment highlighting its advantages to improve water quality. (6 Marks)
- b) Valency and the negative charge on the surface of suspended clay particles are major issues that act against clogging. Discuss this issue using ζ - potential and describe why trivalent cations are chosen as a coagulant. (7 Marks)
- c) In water treatment, flocculation processes are allowed to take place after coagulation. Describe the mechanism of flocculation with the aid of a diagram. (7 Marks)