



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 1 Examination in Engineering: October 2022

Module Number: CE1101

Module Name: Basic Concepts in Environmental Engineering

SECTION – B

[One Hour]

[Answer all questions. Total Marks 30]

Climate change is affecting every country on every continent. Sustainable Development Goal-13 is about climate action and is one of 17 Sustainable Development Goals established by the United Nations General Assembly in 2015. Therefore, the Sri Lankan government also plans to undertake all future infrastructure development projects as "Sustainable Development Projects" in Sri Lanka.

The government wants to develop Hambantota city as the most prominent commercial and industrial city in Sri Lanka and intends to implement all these projects as "Sustainable Development Projects". Figure 1 shows the map of the "proposed Hambantota development plan". Assume you are also included in this project as a young engineer in the planning stage. Answer all the questions based on this "Sustainable Development Projects", as shown in Figure 1.

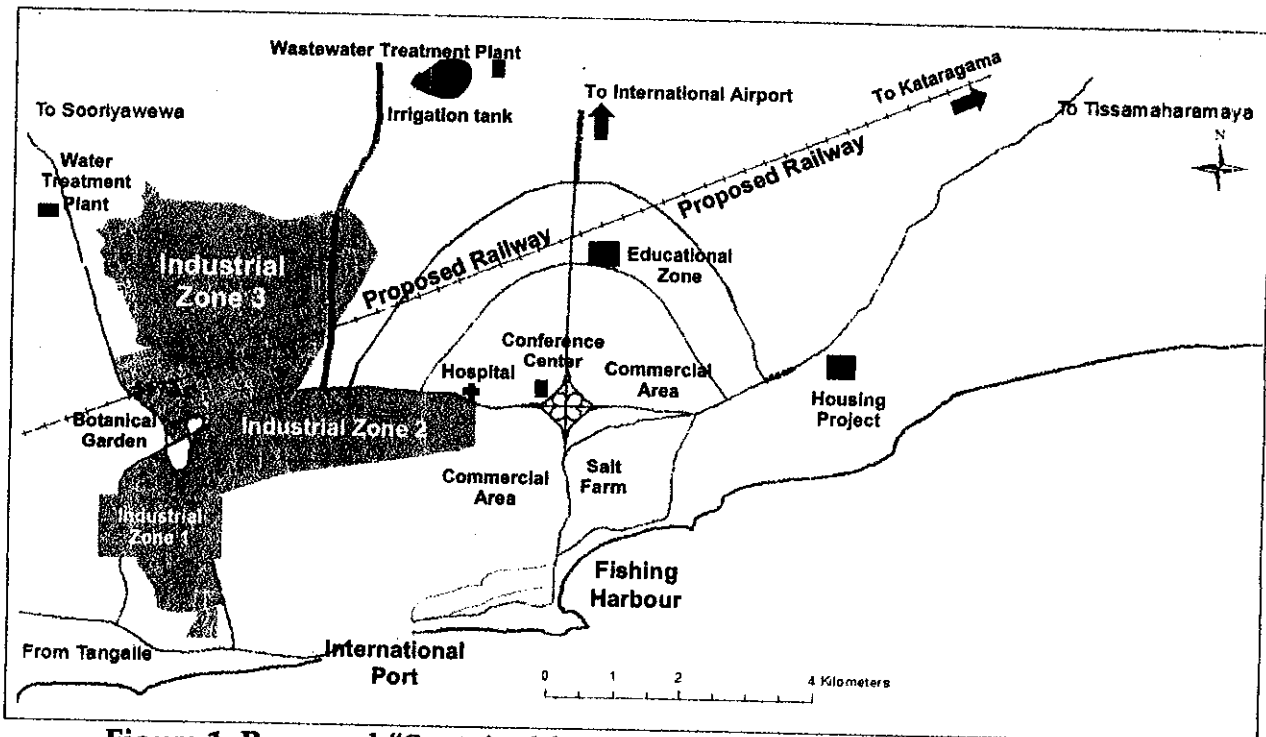


Figure 1: Proposed "Sustainable Development Projects" in Hambantota

Q1) a) The government authorities have planned to extend the southern railway from Beliatta to Kataragama (Figure 1) and undertake this as a sustainable project. Planning

such a sustainable project recognises the interconnections between Three Key Sustainable Aspects. List Two possible factors that may be considered under each Sustainable Aspect during the planning of this railway project. Your answer should be specific to this railway extension project

[4.0 Marks]

c) Railway extension line (from Beliatta to Kataragama) is planned to go through a national forest reserve and several villages. Before the project is implemented, government authorities also intend to evaluate the environmental impacts of this railway project. Railway projects are fallen under the prescribed projects which should be submitted for approval either as an Initial Environmental Examination (IEE) report or Environmental Impact Assessment (EIA) report.

i) Briefly describe how to decide whether an IEE is sufficient, or it should be extended to an EIA.

[1.0 Mark]

ii) Name two positive and two negative impacts of this railway project, to the nearby communities

[2.0 Marks]

iii) Describe the possible impacts of this railway project on fauna in the forest reserve during the railway operation stage

[2.0 Marks]

iv) Describe possible mitigation techniques for noise pollution during the railway operation within the Hambantota city limit

[1.0 Mark]

Q2.) The demand for fresh water in Hambantota city will rapidly increase with the enormous amount of ongoing development projects. As in Figure 1 (right side), there is a proposal for a housing project targeting low-income communities. Environmental engineers in this project's design team plan to install rainwater harvesting systems for all the housing units, to be used only for toilet flushing. Figure Q-2 shows the rough roof's sketch with dimensions (Clay tile roof) for a housing unit. Assume that the average minimum monthly precipitation in this area is 48 mm in the driest month.

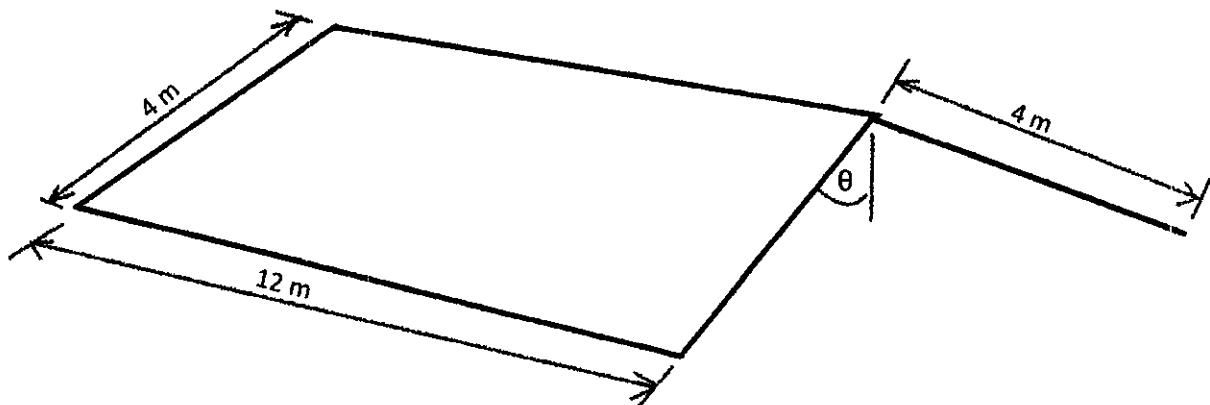


Figure Q2: Dimensions of the roof of a housing unit in the proposed housing scheme

a) Calculate the minimum roof angle (θ , as in Figure Q1) of a housing unit, to be collected enough rainwater only for toilet flushing which was estimated as 25 L/d per person. Assume there are average 4 members in a housing unit. You may assume any other relevant data if needed.

[3.5 Marks]

b) Other than rainwater harvesting what are other sources or methods to manage water demand in Hambantota city for those new projects in sustainable way? List Three (3) such sources or methods.

[1.5 Marks]

c) As shown in Figure 1, it is planned to discharge treated wastewater into a nearby irrigation tank. However, people in the area are afraid of potential "eutrophication" in this irrigation tank. Do you agree with this? Briefly explain your idea.

[1.5 Marks]

d) There is a proposal to construct a water treatment plant in Hambantota as shown in Figure 1. Water engineers in this project have conducted a water quality (WQ) monitoring program. They used an "Indicator Organism" to measure biological parameters. Briefly explain about "Indicator Organism" as biological WQ parameters.

[1.5 Marks]

e) "Water Disinfection" is an important process in water treatment. Name Four methods of water disinfection.

[2.0 Marks]

Q3) a) Climate change is the most significant challenge in achieving sustainable development. Briefly explain the potential global impact of climate change.

[1.5 Marks]

b) Sustainable management of "Water and Wastewater" is one of the factors that can be considered as sustainable development aspects. What are your additional suggestions to achieve sustainable development targets in the proposed Industrial Zones in Hambantota, other than the Water and Wastewater management? Briefly explain Four other factors. (Do Not explain about the Water and Wastewater)

[2.0 Marks]

c) Ambient Air Quality Monitoring is an important part of the air quality management in the proposed industrial zones in Hambantota. There is a proposal to have a factory within this industrial zone that may emit gaseous pollutants into the air. Environmentalists are afraid of the fact that nearby population may experience breathing difficulties and asthma due to this factory.

i) Name Two possible "primarily" pollutants and "secondary" pollutants that may be discharged to the air by the above-mentioned factory

[1.0 Marks]

ii) What are the measures which can be taken to reduce the air pollution level caused by this factory?

[2.0 Marks]

d) Uncontrolled dumping and improper waste handling in these industrial zones may cause land pollution and a variety of environmental and health related problems. Name Four such problems.

[2.0 Marks]

e) Authorities plan to establish integrated and sustainable systems of solid waste management in the Hambantota city and industrial zones. Name Three primary goals of such a Solid Waste Management system.

[1.5 Marks]