UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 1 Examination in Engineering: May 2022

Module Number: CE1101 Module Name: Basic Concepts in Environmental Engineering

SECTION – B

[One Hour]

[Answer **all questions. Total Marks 30**]

Q1. Figure Q-1 shows the draft map of the Hambantota city. There is a proposal of UGC to establish a new "City University" in the Hambantota township by the year 2025. The UGC and relevant authorities suggest putting forward sustainable development concepts in constructing and operating the proposed project.

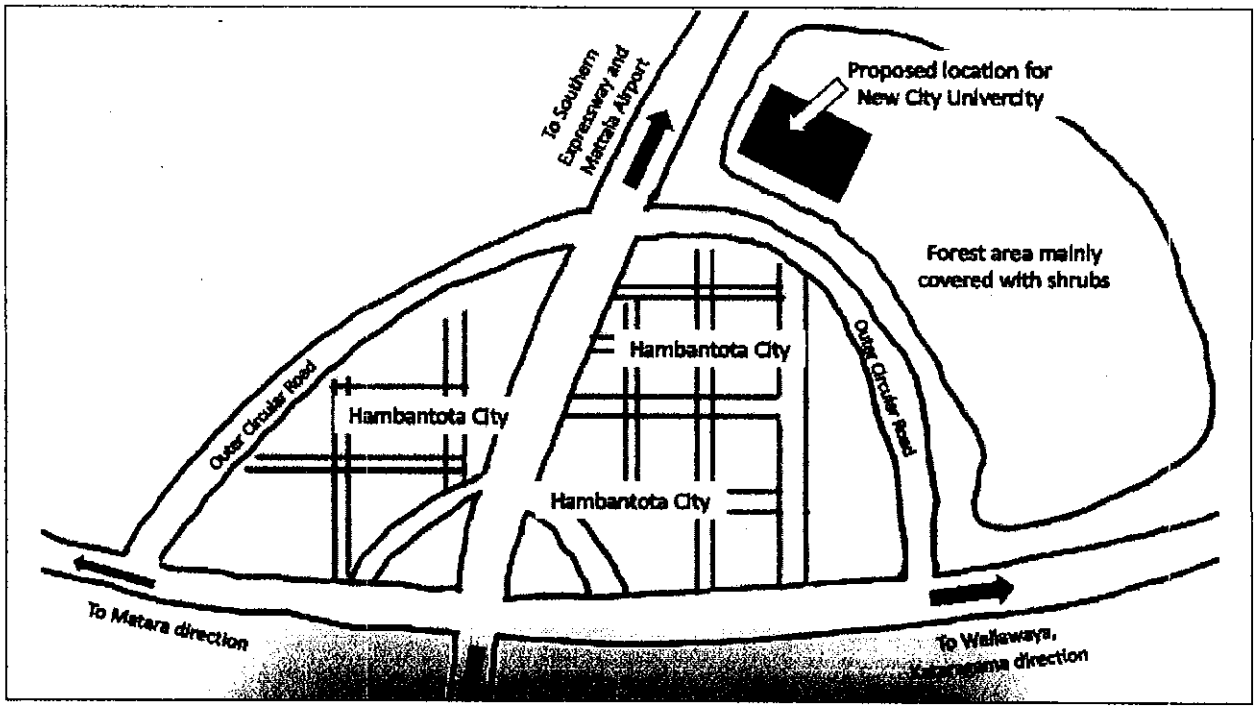

Figure Q-1: Draft map of the Hambantota township

a) "Sustainable development" is a concept that involves meeting present generation's needs without compromising the ability of future generations to fulfil their own needs. Briefly explain the importance of applying sustainable development concepts in constructing and operating the proposed project.

[1.0 Mark]

b) List **two possible factors** that may be considered under each of "Social", "Economical", and "Environmental" aspects, during the planning of the proposed project.

[3.0 Marks]

c) The piece of land allocated for the proposed project is a shrubland, which belongs to the Forest department. Central Environmental Authority has decided that it needs to carry out an Environmental Impact Assessment (EIA) before implementing this project.

i) Briefly explain why an EIA is needed to be carried out before implementing this project.

[1.0 Mark]

ii) List major steps in the EIA process in Sri Lanka.

[3.0 Marks]

iii) The project will increase the human population and human activities in the vicinity of the proposed city university. Name two negative impacts and two positive impacts of this development.

[2.0 Marks]

Q2. The scarcity of water in the Hambantota area is one of the significant issues. Therefore, engineers are considering serval water sources, surface water (Walawe River), groundwater, irrigation tank and rainwater to provide water to a proposed university premises in the Hambantota township.

a) The environmental engineers of this project's design team plan to install rainwater harvesting systems for several buildings of the proposed university. Figure Q-2 shows the dimensions of the clay tile roof in the admirative building where they plan to harvest rainwater. Assume that the average monthly rainfall in this area is 88 mm.

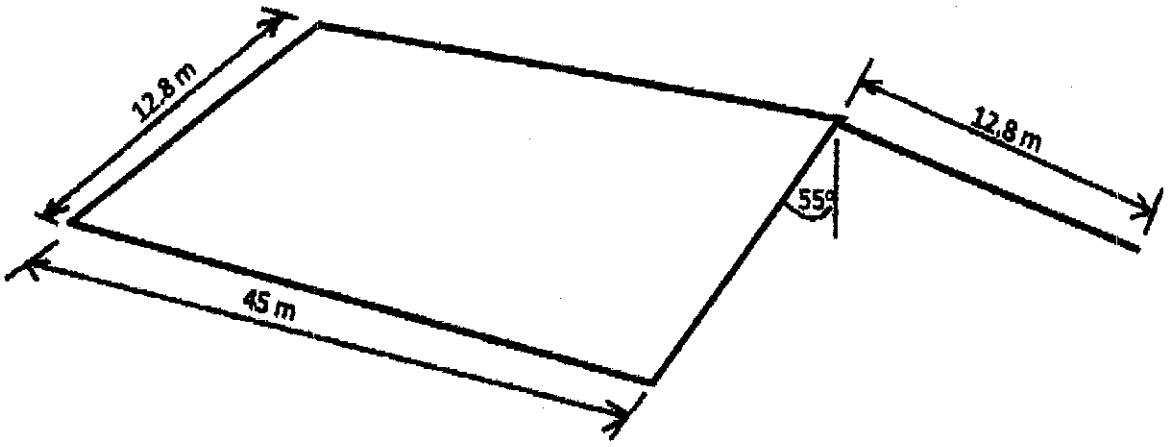

Figure Q-2: Dimensions of the clay tile roof of the administrative building

i) Calculate the volume of rainwater that can be harvested from this building within an average month. You may assume any other data if needed.

[2.0 Marks]

ii) Assume that 40 staff members will work in this administrative building, and it is planned to use rainwater for non-potable usage: toilet flushing, car-washing, and gardening that account for 50 L per person/day. Determine whether enough volume of rainwater can be collected every month for their non-potable usage? Justify the answer with calculations.

[2.0 Marks]

b) The environmental engineers of this project have already conducted a water quality (WQ) monitoring program in this area. They found following WQ results from a nearby tube well in this area:

- *Ca Hardness = 165 mg/L as $CaCO_3$*
- *Mg Hardness = 45 mg/L as $CaCO_3$*
- *Carbonate Hardness = 155 mg/L as $CaCO_3$*
- *Fluoride = 3.5 mg/L*
- *E. coli = 2 in 100 mL*

i) What is the "Total Hardness".

[1.0 Mark]

ii) Calculate the "Temporary Hardness" and "Permanent Hardness".

[1.0 Mark]

iii) What can be the adverse impact due to the high fluoride level of this water?

[1.0 Mark]

iv) Explain the biological quality of this water.

[1.0 Mark]

c) The environmental engineers further found that the Dissolved Oxygen (DO) level of a nearby irrigation tank showed two different results on two different days (6.5 mg/L and 5.6 mg/L, respectively). They measured DO levels using the same DO meter at the same time (around 11:00 am) on both days. Is this difference agreeable? Rationalize the answer.

[2.0 Marks]

Q3) a) The UGC and university authorities want to develop the City University (Figure Q-1) as a "Green Campus".

i) What kind of sustainable development concepts can be applied to the proposed university in terms of energy.

[2.0 Marks]

ii) The authorities want to make this university as "Zero Waste" campus. Briefly explain the concept of "Zero Waste".

[1.0 Mark]

iii) To execute a proper integrated solid waste management plan for this City University, the environmental engineers proposed implementing the "3R" concept. Briefly explain "3R" concepts that can be applied to the proposed City University.

[3.0 Marks]

c) The environmental engineers of this project also suggest implementing a water reclamation and reuse plan for the proposed university. Briefly explain the possible water reclamation and reuse application for the proposed university.

[2.0 Marks]

d) Some environmentalists fear that with the rapid development (industrial parks, port, airport, etc.) of the Hambantota township in the future, the city may experience air pollution issues. What kind of strategies can be followed to minimize the impacts of air pollution in the Hambantota city?

[2.0 Marks]