



(University of Choice)

MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
DOCTOR OF PHILOSOPHY IN DISASTER PREPAREDNESS AND ENGINEERING
MANAGEMENT

COURSE CODE: DPE 906

COURSE TITLE: ADVANCED ENVIRONMENTAL AND WATER RESOURCES
ENGINEERING

DATE: 20/4/2023

TIME: 2-5 PM

INSTRUCTIONS TO CANDIDATES

This paper contains five (5) questions.

Question one (1) is compulsory {total = 30 Marks}.

Attempt any other three (3) {total = 60 Marks} from the remaining questions.

Be brief and to the point.

TIME: 3 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

SECTION 1: COMPULSORY {40 MARKS}

QUESTION 1

An area with a population of 500,000 persons lies in a flood plain. There are 2 Secondary schools, 5 Primary schools, 1 Health centre, and a Shopping centre. The area is crossed by a quasi- seasonal river whose water is used for minor irrigation and domestic consumption despite its high sediment load. Flash flooding occurs in the month of April and sometimes in August leading to human, livestock, and infrastructural loss of about US\$ 100M annually. Over the years the area has witnessed huge gullies being formed due to serious soil erosion, and all attempts by the many GoK and other NGO's mitigate the situation has been unsuccessful. The long rains are experienced from March to May and the short rains are from July to August. Occasionally, some rain falls in the month of December. Severe draught is experienced in the other months leading to death of livestock and drying of crops. Cases of water related diseases as a result of poor sanitation have been encountered. To mitigate this, a number of NGOs have sunk Wells/Bore holes which are also expensive to pump. This area is also known for food deficiency, high child mortality and extremely poor sanitation (pit latrines) that often fail. Generally, the soils in the area are vertisol in nature and is generally endowed with sufficient sunshine hours and abundant wind of high speed.

As an Environmental and Water resources Engineer, discuss how you will plan for this area to use its natural resources (water, wind, sun, land etc.) efficiently, to increase productivity and minimize natural losses and diseases. Discuss in detail the environmental issues in the area and mitigation options. Suggest infrastructural measures and physical measures to be undertaken, propose programmes for food security, water security, drought and floods mitigation, water and sanitation and poverty reduction programs.

SECTION II: ATTEMPT ANY OTHER THREE (3) QUESTIONS {60 MARKS}

QUESTION TWO

Discuss the concept, process and structure of models and modelling as used in Environmental and Water Resources Engineering studies [12 Marks]

Briefly highlight the need and various diagnostic checks of models [8 Marks]

QUESTION 3

Broadly discuss the role of environmental and water resources engineering in sustainable water resources development and management leveraging on SDG goal Nos. 6 & 3 [10 Marks]

Discuss the most important data required for designs of environmental and water resources systems [10Marks]

QUESTION 4

Briefly discuss the various methods for waste water treatment [10 Marks]

Explain how sludge from water treatment plants can be processed to avoid contaminating water (surface and sub-surface), land, and air resources [10 Marks]

QUESTION 5

Discuss in detail the current issues in Water Resources Management and Development in Kenya and the implication of the Water Act 2016 [12 Marks]

Discuss the various stormwater control facilities to improve surface water quality and quantity [8 Marks]