



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

MAIN CAMPUS

UNIVERSITY EXAMINATION  
2021/2022 ACADEMIC YEAR

FIFTH YEAR SEMESTER ONE

SPECIAL AND SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE  
OF

BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 551

COURSE TITLE: WATER RESOURCES ENGINEERING

DATE: 4<sup>TH</sup> OCTOBER , 2022

TIME: 9 – 11 A.M

**INSTRUCTIONS:**

1. This paper contains **FOUR** questions
2. Answer question **ONE** (compulsory) and any other **TWO** question
3. Marks for each question are indicated in the parenthesis.
4. Examination duration is **2 Hour**

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of ~~3~~<sup>2</sup> Printed Pages. Please Turn Over.



**QUESTION 1 (30 Marks)**

- (a) Discuss factors considered in design of water harvesting structure [15 Marks]
- (b) Design a water pan for storage of runoff in an ASAL catchment. The following data are given: Population= 100 people and 700 heads of animals; Daily Consumption (20lit/day/capita for domestic and 35lit/day/head for animals); Effective Catchment Surface area = 20 Acres; the evaporation losses is estimated from a reservoir with average surface spread of 3.3 km<sup>2</sup> in December with the water surface temperature of 22.5 °C, relative humidity of 35%, wind velocity measured at 2.0m above the ground at a nearby observatory is 15km/h. Assuming this evaporation loss is average for all other months and given the monthly rainfall in the area is as in table below: [30 Marks]

Months	Jan	Feb	March	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec
Rainfall(mm)	25	35	60	120	105	30	20	25	35	50	65	50

**QUESTION 2 (20 Marks)**

- (a) Differentiate between gravity Dam and Earthen Dam [5 marks]
- (b) In designing a concrete gravity dam, discuss the parameters that must be taken into account for stability to be realized. [15 Marks]

**QUESTION 3 (20 Marks)**

- (a) Explain why water resources projects should be planned. [5 Marks]
- (b) Discuss the five stages of water resources planning process [15 Marks]

**QUESTION 4 (20 Marks)**

Lack of appropriate technical designs, policy etc. among other factors, has led to low adoption of rainwater harvesting technology, especially in Arid and Semiarid Lands (ASAL). This calls for interdisciplinary approach and optimization of Rain Water Catchment Systems (RWCS) design parameters as well as formulation of comprehensive water policy. Discuss. [20 Marks]

**Some Useful Formula:**

$$E = C \left[ 1 + \frac{U}{16} \right] (e_s - e_a)$$

