(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR

FIFFTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 551

COURSE TITLE: WATER RESOURCES ENGINEERING

DATE: 14TH DECEMBER 2023   **TIME : 8 A.M – 10 A.M**

INSTRUCTIONS:
1. This paper consists of **FOUR** questions
2. Answer question **ONE** and **ANY** other **TWO** questions
3. All symbols have their usual meaning unless otherwise stated

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

Question 1. 30 Marks

(i) Describe the five components of Integrated Water Resources Management that are handy during the water resources planning for a community and one challenge facing each.

(10 marks)

(ii) A design of an Ogee Spillway to be used to discharge a flood from a dam with the following data is to be made.

Height of the spillway crest above the river bed=100m

Design discharge = 12,000m^3/s   k=2, n=1.85

Proposed Number of spans=6,

Clear distance between piers = 15m,

Thickness of the pier=3m,

Slope of the downstream face of overflow section = 0.8:1 C_d=2.3

a) Compute the clear waterway length, and total head over the crest including the velocity head. **(4 marks).**

b) Compute the effective length of the spillway, assume K_p=0.02 and K_a=0.2 **(4 marks).**

c) Determine the velocity of approach **(2 marks).**

d) Determine and comment on the head due to velocity of flow. **(1 mark).**

e) State a matematical expression for the upstream face given k=2 and n=1.85 **(2 marks)**

f) Given the downstram slope has 0.8H: 1V, state the mathematical expression of the slope, providing the maximum value of X (horizontal axis) and Y (vertical axix) **(2 marks).**

(iii) As an upcoming Engineer, discuss five areas on how you will apply the skills gained in the Water Resources Engineering course. **(5 marks)**

Question 2. 20 Marks

(i) Disciss the functions of guide banks as an effort to train a river.   **(5marks).**

(ii) Discuss the measures that can be used in management or control of groundwater from Sea Water Intrusion especially to the boreholes within the vicinity   **(5 marks).**

(iii) Discuss the causes of failure in Earthdams   **(4 marks).**

(iv) A flow net is plotted for a homogeneous earthen dam of height 25m and length 2000m with a free board of 2 m. the results obtained indicate number of potential drops as 10 and the

number of flow channels as 4. The dam has a horizontal filter of 30m at the downstream end and the coefficient of permeability of the dam material is 5×10^{-4}cm/sec. Calculate the discharge through the dam **(4 marks).**

(v) Fresh water on mixing with saline water forms a wedge into the sea. Using Ghyben-Herzberg relation, demonstrate that there is 40 times more fresh water below the mean sea level than above it in the interface between salt water and fresh water. **(2 marks)**

Question 3. 20 Marks

(i) Describe the factors that influence sea water intrusion into the aquifers that border the oceans. **(5 marks).**

(ii) Kyekolo river catchment is a small subcatchment of Kaiti River in easter Kenya with an area of about 50ha. During elnino rains, a gully developed required a rehabilitation as well as a drop spillway, the rainfall intensity is captured as 12cm/hr in a 50 years return period. Design a drop structure given the bed has a height of 2m, take runoff coefficient as 0.35 specifying the maximum length of the headwall, length of apron and height of the tranverse sill. **(10 marks).**

(iii) Mining activities have been happening in Ikolomani and Migori of Western Kenya and nyanza respectively. Discuss the long term challenges likely to be experienced from this economic activity. **(5 Marks)**

Question 4. 20 marks

(i) The following hydraulic data pertains to a bridge on a a tibutary of river nile whose course keeps changing;

Maximum discharge=6000m³/sec.

Highest flood level=104m.

Riverbed level=100m.

Average diameter of riverbed material=0.1mm.

Assume the site has a clear water way

a) Design a guidebank clear water way length including the launching apron to train the river, length of the guide bank upstream and downstream **(5marks).**

b) Calculate the length of the curved heads of the guide banks **(1 mark).**

c) Sketch the guide banks showing length, nose, curved ends, both upstream and downstream. Assume a freeboard of 1.5m. **(3 mark).**

d) Compute the velovity head **(1 mark).**

(ii) A sand dam is to be constructed in the floodplain of the river in anarid part of the northeastern part of kenya. Before the actual design work, geological investigation was done to the dam site. Discuss the kind of data captured in the report. **(5 marks).**

(iii) Sedimentation is one of the threat to design capacities for dams hence increasing operation and maintenance costs. Describe five preventive measures that can be used to control sedimentation in reservoir **(5 marks).**