MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS

2013/2014 ACADEMIC YEAR

FIFTH 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 II

DATE: **TIME: 3 HOURS**

INSTRUCTIONS TO CANDIDATES

1) This paper consists of SIX questions

2) Attempt ALL Questions in Section A and any THREE Questions in Section B

SECTION A (Compulsory)

Question One

a) Outline the importance of economic analysis in Water Resources projects **(5 marks)**

b) The following alternative plans for reducing flood damages along a reach of river Nzoia are being considered

Plan A: Channel improvements

Plan B: flood retarding dam 1

Plan C: flood retarding dam 2, which is at the same site but is larger than dam 1

Plan D: Both the channel improvements and dam 1

Plan E: Both the channel improvements and dam 2

Without implementation of flood control plans, the average annual flood damages of USD 525,000 per year. The project costs are indicated in table 1

Table 1: Project costs (USD)

Plan	Initial investment	Operation & Maintenance	Average annual damages
A	380,000	125,000	312,000
B	1,620,000	77,000	238,000
C	1,970,000	113,000	156,000
D	2,000,000	202,000	125,000
E	2,350,000	238,000	83,000

Using a discount rate of 8 percent and 50 years analysis period , select the optimum plan based on the objective of *minimizing annual cost*, *maximizing net benefits*, and *benefit cost ratio* **(16 marks)**

Question Two

a) Determine the discharge through a chute spillway of ogee crest; length of spillway is 250m, height of spillway crest above upstream approach channel is 10m, width of approach channel is 250m, and depth of water over spillway crest is 5m. Assume Coefficient of discharge is 2.5 **(8 Marks)**

b) Apart from water harvesting, outline any other method of relieving pressure on water resource for crop production in Arid and Semi-arid areas **(2 marks)**

SECTION B (Attempt any THREE Questions)

Question Three

a) Show that, in coastal areas, the depth to the freshwater/seawater interface is about 40 times the height of the freshwater above sea level   **(8 marks)**

b) Outline ways of preventing seepage through embankment dams   **(5 marks)**

Question Four

a) Define meteorological, agricultural and hydrological droughts   **(3 Marks)**

b) Describe flood water harvesting techniques for water resource management in Arid and Semi-arid areas of Kenya   **(10 marks)**

Question five

a) Calculate the forces on given dam if; the specific weight of dam material and water is 2.5 t/m³ and 1 t/m³ respectively. The height of wave in the dam is1.5 m and the depth of water in the reservoir is 33m.

Assume earthquake coefficients, C_e = 0.82 and α = 0.1   **(8.5 marks)**

b) Determine the stability of the dam in (a) above, against;

- Tension at the base
- Overturning
- Sliding if the safe friction coefficient μ=0.7   **(4.5 marks)**
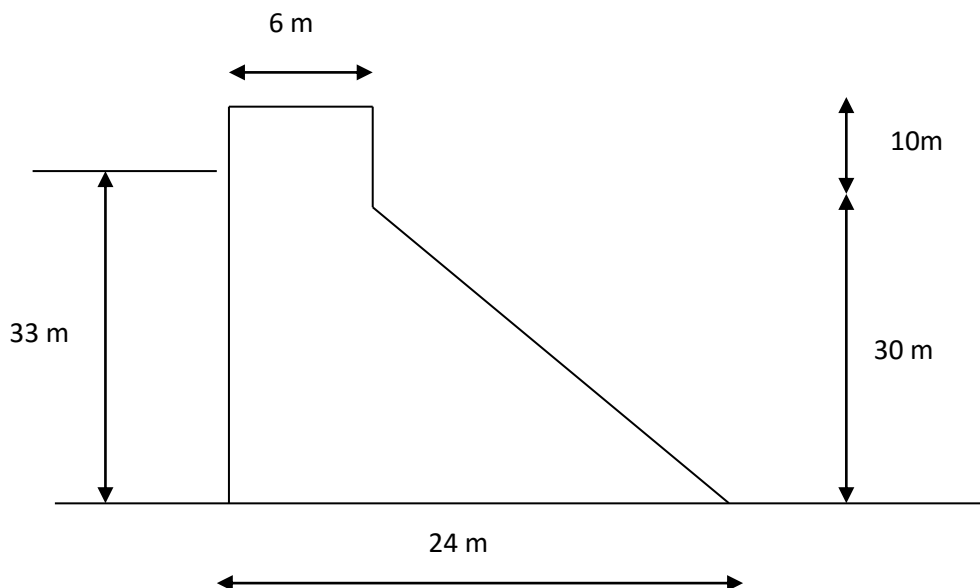
Question Six

a) The yield of water from a catchment area during each successive month is

(1.4, 2.1, 2.8, 8.4, 11.9, 11.9, 7.7, 2.8, 2.52, 2.24, 1.96, 1.68) x 10^6 m^3

Determine the minimum capacity of a reservoir required to allow the above volume of water to be drawn off at a uniform rate assuming that there is no loss of water over the spillway using analytical method.   **(5.5 marks)**

b) Briefly describe the following river training works   **(7.5 marks)**

   i.   Check dams

  ii.   Spurs

 iii.   Levees

Formulae table

Single-payment present worth factor	$P = F/(1+i)^n$
Sinking fund factor	$A = F\dfrac{i}{(1+i)^n - 1}$
Capital recovery factor	$A = P\dfrac{i(1+i)^n}{(1+i)^n - 1}$
Uniform series compound amount factor	$F = A\dfrac{(1+i)^n - 1}{i}$
Uniform series present worth factor	$P = A\dfrac{(1+i)^n - 1}{i(1+i)^n}$