



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FOURTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 402: IRRIGATION ENGINEERING 1

DATE: 29/7/2019

TIME: 2.00-4.00 PM

INSTRUCTIONS:

- This paper contains FIVE (5) questions
- Answer ONE and ANY OTHER TWO (2) questions
- All questions has equal total marks
- All symbols have their usual meaning unless otherwise stated

QUESTION 1 – COMPULSORY (30 MARKS)

- a) Describe sources for water for irrigation and the methods that can be used to tap the resources for irrigation purposes (10 marks)
- b) Using illustrations, describe critical moisture content and Readily available moisture as regards crop water relationships (10 marks)
- c) Discuss THREE (3) categories of sources of water for irrigation. (3 marks)
- d) Describe the following terms (7 marks)
 - i. Saturation water content
 - ii. Field capacity
 - iii. Permanent wilting point
 - iv. Total available moisture

QUESTION 2(20 MARKS)

Discuss irrigation water Efficiencies (20 marks)

QUESTION 3(20 MARKS)

- a) Estimate the potential evapotranspiration for a crop for the month of June using the Thornthwaite equation from the following data. (15 marks)

<i>Month</i>	<i>Apr.</i>	<i>may</i>	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sep.</i>	<i>Oct.</i>
<i>Temp. T_m ($^{\circ}\text{C}$)</i>	<i>4.5</i>	<i>12.5</i>	<i>20.4</i>	<i>20.2</i>	<i>21.5</i>	<i>10.5</i>	<i>5.5</i>
<i>Max. sun shine hrs</i>	<i>370</i>	<i>380</i>	<i>365</i>	<i>358</i>	<i>355</i>	<i>350</i>	<i>345</i>

- b) What is deficit irrigation (5 marks)

QUESTION 4 (20 MARKS)

- a) What is effective rainfall and describe methods of its estimation (8 marks)
- b) What are the various methods of determining evapotranspiration (6 marks)
- c) Describe how you would develop a crop coefficient curve (K_c -curve) (6 marks)

QUESTION 5 (20 MARKS)

A representative soil sample is taken in the root zone ($Z = 0.6$ m) of potatoes cultivated on a sandy loamy soil ($\gamma_b = 1.40$). The weight of the soil sample before and after drying is 133g and 114g, respectively. The field capacity of the soil is 31 vol% and the wilting point of 6%.

- i). How much run-off is expected after a heavy rainfall of 60 mm.
- ii). Calculate the daily water balance of the root zone of potato ($Z = 0.6$ m, $p = 0.5$)

Cultivated on the soil for a 10-day period, if

- the soil sample was collected at the start of the 10-day period
- the heavy rainfall of 60 mm (10 % is lost to surface runoff) was observed in day 2
- the mean potential evapotranspiration is 6 mm/day

(20 marks)