FACULTY OF NATURAL RESOURCES MANAGEMENT AND AGRICULTURE

DEPARTMENT OF HORTICULTURE AND CROP PRODUCTION

PROGRAMME: BSc HONOURS CROP SCIENCE

LCS4213: IRRIGATION AGRONOMY

FINAL EXAMINATION

APRIL 2024

This examination paper consists of 3 pages.

Time Allowed: **3 hours.**

Total Marks: **100**

Special Requirements: **Scientific calculator (supplied by student)**

Examiner's Name: **Eng. Madzaramba T.**H

Instructions

1. Answer **ALL** questions in Section A
2. Answer any **THREE (3)** questions in Section B

Mark allocation

Question	**Marks**
Section A	40
Section B	60
Total attainable marks	100

SECTION A: Answer **ALL** questions.

Question 1

a) Briefly explain the meaning of the following terms
   i. Reference Crop Evapotranspiration (ETo) [3]
   ii. Management allowable depletion (MAD) [4]
   iii. Soil Structure [4]
   iv. On-farm water management (OFWM) [6]

b) A farmer plans to operationalize an irrigation system for a new crop enterprise at the farm. The following crop, soil, and climatic data is provided to assist the farmer to accomplish this task:
   Crop: Soya bean at flowering stage.
   Moisture extraction depth: 600mm.
   Soil type: Sandy clay loam.
   Available moisture is 12.5% and depletion is 55%.
   The average daily evapotranspiration loss is 5mm, crop factor is assumed to be 0.70, and irrigation efficiency is 0.85. The area to be irrigated is 25 ha. In addition, the maximum permissible precipitation rate is 15mm/hr, and root zone depth is 70cm.
   Determine the following:
   i. Total available moisture [3]
   ii. Net depth of water application [3]
   iii. Irrigation frequency [4]
   iv. Gross depth of water application (Dgross) [4]
   v. Set time [4]
   vi. System capacity [5]

[40]

SECTION B: Answer any **THREE** questions.

Question 2

Irrigation development in Zimbabwe continues to slow following the land reorganization that began in the early 2000s. Evaluate the constraints to irrigation development in Matabeleland South Province. [20]

Question 3

a) Enumerate the benefits of center-pivot irrigation systems. [10]

b) State the name and function of five (5) main components of a center-pivot. [10]

Question 4

a) Outline the negative effects of irrigation in commercial farming [10]

b) Given the following information:

Class A evaporation pan type,

Water depth in pan on day 1 = 16 cm.

Water depth in pan on day 2 = 15.4 cm (after 24 hours).

Rainfall (during 24 hours) = 0 cm.

Assume K pan = 0.85 and a maize crop 60 days after planting.

Determine Et_o and ET_{crop} [10]

Question 5

A student was asked to carry out a pre-feasibility study for a community irrigation development project. The following soil and crop data was obtained: The total irrigable area earmarked for development is 200 ha, and the dominant soil type is clay loam. The community plans to grow sugarcane with peak daily water use of 7.5 mm/day. Soil moisture assessment indicated available moisture of 16 cm/m, allowable moisture depletion of 0.6 and a root zone depth of 0.95 m. The soil infiltration rate was 5-6 mm/hr and the community is located in a moderate climate zone.

Assuming a working day of 10hrs, determine the following:

a. Dnet [3]

b. IF [3]

c. Dgross [4]

d. Q (m^3/hr) [5]

e. Braking horsepower of pump at 60m head. [5]

Question 6

a) Describe in detail the following two methods of moisture assessment:

i. Tensiometer [4]

ii. The feel method [4]

b) A soil sample was collected from the field with the help of a core sampler whose diameter and length are 50mm and 100mm respectively. The total weight of the soil collected was 3.90kg. A portion of this wet soil which was (96g) was oven-dried and the weight of the dry soil was 80g. Calculate the moisture content of the soil on a percent weight basis as well as on a volume basis [12]

END OF QUESTION PAPER!!!