MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2013/2014

SECOND YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN HORTICULTURE WITH INFORMATION TECHNOLOGY

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THIRD YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN HORTICULTURE WITH INFORMATION TECHNOLOGY

(MAIN CAMPUS)

AAG 207/SHC 314: SOIL AND WATER ENGINEERING

Date: 11th April, 2014 Time: 8.30 – 10.45 a.m.

INSTRUCTIONS:

- **Answer ALL questions in Section A and ANY THREE in Section B.**

SHC 314/AAG 207: SOIL AND WATER ENGINEERING

DATE: ...????... TIME: ????

INSTRUCTIONS:
This paper comprises sections A and B.
Answer ALL questions in section A and any THREE questions in section B.

SECTION A (40 Marks): Answer ALL questions in this section.

QUESTION 1: Define the following concepts and explain their significance in irrigated planning.

(a)	Reference crop evapotranspiration, ETo	(1 Marks)
(b)	Crop evapotranspiration, ETc	(1 Marks)
(c)	Net irrigation requirement, NIR	(1 Marks)
(d)	Gross irrigation requirement, GIR	(1 Marks)
(e)	Irrigation interval, II	(1 Marks)
(f)	Available water capacity, AWC	(1 Marks)
(g)	Readily Available Water, RAW	(1 Marks)
(h)	Water application efficiency	(1 Marks)
(i)	Water conveyance efficiency	(1 Marks)
(j)	Water use efficiency, WUE	(1 Marks)

QUESTION 2:

a) Explain clearly the components of total dynamic head for a sprinkler irrigation system. (2.5 Marks)
b) Define the Bernoulli energy equation indicate how it can be applied in hydraulics. (2.5 Marks)
c) Explain briefly two situations when extra irrigation water application may be required in irrigation ? (2.5 Marks)
d) Explain why you need to provide adequate submergence of the suction inlet for a pump (2.5 Marks)

QUESTION 3.

What is the significance of the following in a typical centrifugal pump and pump assembly?

i.	Pump shaft	(1 Mark)
ii.	Impeller	(1 Mark)
iii.	Oil sump	(1 Mark)
iv.	Suction line length and lift	(2 Marks)
v.	Packing gland	(1 Mark)
vi.	Bearings	(1 Mark)
vii.	Foot valve on suction line	(1 Mark)
viii.	Pump priming	(2 Mark)

QUESTION 4.

i. A soil has an average soil moisture content of 36.5% at field capacity and 13.5 % at permanent wilting point on dry weight basis. The bulk density of the soil is 1.6g cm-3. Find out the available soil per meter depth of soil profile. (2 Marks)

ii. Briefly describe the functions of the following components of a drip irrigation system.

(a)	Chemical injection system	(1 Mark)
(b)	Filtration system	(1 Mark)
(c)	Flush valves	(1 Mark)
(d)	Backflow prevention device	(1 Mark)

iii) Briefly explain the Thiessen method for computing areal rainfall (4 Marks)

SECTION B: Answer any THREE questions in this section. Each question carries 10 marks.

QUESTION 5

Discuss the most important aspects to consider in the design of a sprinkler irrigation system. (10 Marks)

QUESTION 6

A 12 Hectare farm is to be irrigated with a sprinkler system. The rootzone depth is 0.8 metres and the field capacity for the soil is 26% while the permanent wilting point is 14% by weight. The soil bulk density is 1.36 g cm-3 and the water application efficiency is 70%. The soil has to be irrigated when 50% of the available water is depleted. The peak evapotranspiration is 4 mm/day and the system is to be run for 10 hours.

Determine:

(i) The net irrigation depth (2 Marks)

(ii) Gross irrigation ie. the depth of water to be pumped (2 Marks)

(iii) Irrigation period (2 Marks)

(iv) Area to be irrigated per day and (2 Marks)

(v) the system design capacity. (2 Marks)

QUESTION 7

A stream of 135 litres per second was delivered from a canal and 100 litres per second was delivered to the field. An area of 1.6 hectares was irrigated in 8 hours. The effective depth of the root zone was 1.8 m. The run-off loss in the field was 432 m^3 and the depth of water penetration varied linearly from 1.8 m at the head of the field to 1.2 m at the tail end. Available moisture holding capacity of the soil is 20 cm per metre depth of soil. Determine the

i. water conveyance efficiency, (2.5 Marks)

ii. water application efficiency, (2.5 Marks)

iii. water storage efficiency and (2.5 Marks)

iv. water distribution efficiency. (2.5 Marks)

Irrigation was started at a moisture extraction level of 50% of the available moisture.

QUESTION 8

a) Discuss the following salinity control proposals:

i. Pre-plant irrigation (2.5 Marks)

ii. Localized water application (2.5 Marks)

iii. Seedbed preparation and seed placement (2.5 Marks)

iv. Crop residues and manures. (2.5 Marks)

b) Discuss the evaporation pan method for determining potential evapotranspiration. (5 Marks)