



JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS 2016/2017

**SECOND YEAR FIRST SEMESTER UNIVERSITY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURE**

ALP 2305: AGROMETEOROLOGY & CROP WATER REQUIREMENT

DATE: DECEMBER, 2016

TIME: 2 HOURS

**INSTRUCTIONS: ANSWER SECTION A (COMPULSORY) AND ANY OTHER
QUESTIONS**

Constants: $\frac{\Delta}{s(r)} = 0.738,$

$$\frac{r}{\Delta + r} = 0.262,$$

$$A = 6.02 \times 10^{23} \text{ Photons/mol}$$

$$c = 3.0 \times 10^8 \text{ m/s}$$

$$h = 6.626 \times 10^{-34} \text{ js/photon}$$

SECTION A:

QUESTION ONE: 30 MARKS

a. i. List the main importance of Agrometeorology. [2 ½ marks]

ii. Using a sketch of standard layout of an Agrometeorology field station. Indicate the positions of:-

- Anemometer
- Sunshine recorder
- Evaporation pan
- Stevenson screen

[3 marks]

b. i. Define the following terms:-

- Relative humidity
- Specific humidity
- Vapour pressure
- Saturated vapour pressure

[2 marks]

ii. At an Agrometeorology station, air pressure is measured as 100kPa, air temperature as 18°C and the wet bulb temperature as 14°C.

Calculate:

- Vapour pressure. [3 marks]
- Relative humidity. [2 marks]
- Specific humidity. [2 marks]
- Air density. [3 ½ marks]

iii. Explain in details the following:-

I. Diurnal variation of relative humidity. [3 marks]

II. The effect of relative humidity on

- Leaf growth. [3 marks]
- Photosynthesis. [3 marks]
- Pollination. [3 marks]

SECTION B:

QUESTION TWO:

a. Explain in details the following types of drought:-

i. Meteorological.

ii. Agricultural.

iii. Hydrological. [9 marks]

b. The electromagnetic energy (E), emitted by the sun is given as $E = \frac{hc}{\lambda}$

$$\frac{hc}{\lambda}$$

i. Define the terms in the equation. [2 marks]

ii. Calculate Energy emitted by the following parts of the electromagnetic spectrum.

I. Blue - 500nm

II. Cyan - 550nm

III. Red - 700nm [6 marks]

c. Explain in detail the main parts of the electromagnetic spectrum that affect crop growth. [3 marks]

QUESTION THREE: 20 MARKS

- a. i. Explain the forces affecting a water drop in the atmosphere. [3 marks]
Illustrate your answer.
- ii. Use the forces explained in Q3 (a) to derive an expression for a water drop terminal velocity. [5 marks]
- iii. Calculate the terminal velocity of a 1mm diameter rain drop falling in the atmosphere, given drag coefficient = 0.071, density of water = 998kg/m³ density of air = 1.20kg/m³. [5 marks]
- iv. Explain the influence of rainfall in crop production. [2 marks]
- b. A drainage basin of 600km² area Isohyets are drawn as shown in table Q3 (b). Use the data to estimate area rainfall. [5 marks]

| | | | | | |
|-------------------------|-------|------|-----|-----|-----|
| Isohyetal interval | 15-12 | 12-9 | 9-6 | 6-3 | 3-1 |
| Area (KM ²) | 92 | 128 | 120 | 175 | 85 |

QUESTION FOUR:

- a. i. In establishment of an irrigation scheme, why is it important to study the crop water requirement? [2 marks]
- ii. The Penman's equation for calculating open water evaporation is given as:-
- $$E = \frac{\Delta H + rE_a}{\Delta + r}$$
- $$E_a = 0.35 \left(1 + \frac{u^2}{160} \right) (e_s - e_a)$$
- I. Name the parameters in the equation. [3 ½ marks]
- II. Calculate E given, u₂ = 85km/day, H = 7.10mm/day and the other atmospheric conditions are as given Q 1 b (ii). [5 marks]
- iii. Explain in details how climatic and crop characteristics affect evapotranspiration rate. [5 marks]
- b. Discuss in details the causes of climate variability and climate change. [4 ½ marks]