



**UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER**

PROGRAMME: BSC ABE. II

COURSE CODE: ABE201

TITLE OF PAPER: AGROCLIMATOLOGY

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO
OTHER QUESTIONS.**

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SECTION I COMPULSORY

QUESTION 1

- a) Define the following terms as used to explain the interaction of radiation with earth:
- | | | |
|-------|------------------------|-----------|
| (i) | Rayleigh scattering; | [4 marks] |
| (ii) | Terrestrial radiation; | [4 marks] |
| (iii) | Planetary albedo; | [4 marks] |
| (iv) | Insolation; | [4 marks] |
| (v) | Ozone | [4 marks] |

- b) Explain the following equations as they are used in describing the conditions necessary for evapotranspiration to take place.

$$T_r = g_w \times (H_i - H_a)$$

Where T_r is the transpiration rate [5 marks]

$$g_w = 1/(r_l + r_b)$$

Where g_w is leaf conductance [5 marks]

$$1/r_l = 1/r_s + 1/r_c$$

where r_l is leaf resistance [5 marks]

- c) Clearly explain the relationship between temperature and vapour pressure, explaining how it affects vapour pressure deficit, also what dew point temperature is.

[5 marks]

SECTION II ANSWER ANY TWO QUESTIONS**QUESTION 2**

- a) On a local basis, some areas receive surplus and some a deficit in terms of radiation heat budget, and that may be related to latitude. However, these places are not necessarily getting any hotter for the surplus areas, or any colder for the deficit areas. This is due to various mechanisms that enable the flow of energy from the tropics to the higher latitudes. Explain the 3 major mechanisms that ensure the energy balance on a global scale. [15 marks]
- b) Discuss the three steps of photosynthesis as outlined below, mentioning the conditions required for these to take place:
- (i) Assimilation of carbon dioxide [5 marks]
 - (ii) Photochemical phase of photosynthesis [5 marks]
 - (iii) Biochemical phase of photosynthesis [5 marks]

QUESTION 3

- a) Explain how the following factors may be probable causes for climate variability:
- Sunspot cycle [5 marks]
 - El Nino Southern Oscillation (ENSO) [5 marks]
 - Land surface changes [5 marks]
- b) According to Oseni and Masarirambi's 2011 paper "Effect of Climate Change on Maize (*Zea mays*) Production and Food Security in Swaziland", reduced/erratic rainfall during the years resulted in decreased maize production. However, rainwater harvesting/soil conservation techniques, intercropping, growing of short duration/early maturing maize varieties, crop diversification are some of the techniques that could be used as means to adapt to the impacts of a changing climate in Agriculture.

Discuss the techniques mentioned and how they may help in adaptation.

[15 marks]

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QUESTION 4

a) Explain:

- (i) Why the sun emits radiation energy in shorter wavelength while the earth emits in longer wavelength [5 marks]
- (ii) The effect of organic matter on the soil's thermal diffusivity [5 marks]
- (iii) Why air Temperature peak lags behind radiation peak for daily measurements [5 marks]
- (iv) Why crop evapotranspiration may be less than potential evapotranspiration [5 marks]

b) Explain how the siting, installation and reading of the rainguage may be the source of error in measurement of rainfall.

[10 marks]