



**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) Discuss the following laws as used to explain the behaviour of electromagnetic radiation:

- (i) Stefan-Boltzman Law;
- (ii) Wien's Law;
- (iii) Kirchoff's Law;

[15 marks]

b) Using graph in Appendix 1, determine:

- (i) the saturated vapour pressure at 30 °C;
- (ii) the actual vapour pressure, when the relative humidity (RH) is 65 %;
- (iii) vapour pressure deficit (VPD) under conditions in (i) and (ii);
- (iv) the temperature at which 100 % RH would be achieved, assuming no more water vapour is added to the air.

[12 marks]

c) Below are recorded temperatures (maximum and minimum) for Bhunya area between February 19 and February 21.

Date	Maximum °C	Minimum °C
19 February	29.9	12.6
20 February	32.1	11.2
21 February	34	11.1

Calculate the modelled air temperature at 10 am and 5 pm on the 20<sup>th</sup> February.

$$\Gamma(t) = 0.44 - 0.46 \sin(\omega t + 0.9) + 0.11 \sin(2\omega t + 0.9)$$

where  $\omega = \pi/12$ , and  $t$  is the time of day in hours ( $t=12$  at solar noon)

The temperature for any time of day is given by:

$$\begin{aligned} T(t) &= T_{x,i-1}\Gamma(t) + T_{n,i}[1 - \Gamma(t)] & 0 < t \leq 5 \\ T(t) &= T_{x,i}\Gamma(t) + T_{n,i}[1 - \Gamma(t)] & 5 < t \leq 14 \\ T(t) &= T_{x,i}\Gamma(t) + T_{n,i+1}[1 - \Gamma(t)] & 14 < t \leq 24 \end{aligned}$$

$T_x$  is the daily maximum temperature and  $T_n$  is the minimum temperature.

[13 marks]



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

- a) With the aid of a diagram, discuss the three (3) stages of evaporation from a soil surface, from the moment just after a rainfall event to when most of the water has been removed from the soil.

[15 marks]

- b) Explain how the following climatic parameters influence evapotranspiration:

- (i) Solar radiation
- (ii) Air temperature
- (iii) Wind

[15 marks]

**QUESTION 3**

- a) Discuss with illustrations, the process of enhanced greenhouse effect as a cause of a changing climate.

[15 marks]

- b) According to the Food and Agriculture Organisation (FAO), “climate smart agriculture (CSA) is an approach for developing agricultural strategies to secure sustainable food security under climate change”. Discuss at least 5 of these strategies or techniques.

[15 marks]

**QUESTION 4**

- a) Explain how the following are different from each other:
- (i) How heat is 'trapped' in a greenhouse and how it is 'trapped' in the atmosphere
  - (ii) Lapse rate and dry adiabatic cooling
  - (iii) Effective rainfall and dependable rainfall
  - (iv) Reference evapotranspiration and crop evapotranspiration

[20 marks]

- b) Explain the heat unit concept as a crop production theory; explaining how the heat units accumulate, also outlining the theory's shortcomings.

[10 marks]

APPENDIX 1

