



**UNIVERSITY OF ESWATINI  
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) In rainfed agriculture, the crop water requirement is generally met from rainfall. When deciding whether a certain crop can be grown in a certain location, one of the factors considered is the **dependable rainfall**.
- (i) Define dependable rainfall [5 marks]
- (ii) Table 1 shows a 30-year record of observed rainfall, using the ranking method, determine the dependable rainfall. [5 marks]
- (iii) Assuming the rainfall data is normally distributed; use Equation 1 below to calculate the dependable rainfall. [5 marks]

$$P_{\text{dep}} = p - 0.84\sigma \dots \dots \dots \text{Equation 1}$$

Where  $p$  is the mean annual rainfall

$\sigma$  is the standard deviation of annual rainfall, where

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{N}}$$

Table 1: Annual Rainfall recorded at Weather Station X for years 1989 to 2018

Year	Rainfall (mm)	Year	Rainfall (mm)	Year	Rainfall (mm)
1989	729	1999	833	2009	633
1990	925	2000	509	2010	599
1991	425	2001	631	2011	589
1992	625	2002	735	2012	677
1993	711	2003	547	2013	604
1994	439	2004	401	2014	776
1995	633	2005	389	2015	813
1996	545	2006	555	2016	543
1997	833	2007	589	2017	612
1998	735	2008	729	2018	712

- b) Discuss the El Nino/Southern Oscillation (ENSO) phenomenon, as one of the causes of climate variability. [10 marks]
- c) Explain how the following factors may be drivers of climate change:
- Radiative forcing from anthropogenic aerosols
  - Radiative forcing from Greenhouse Gases
  - Radiative forcing from land surface changes
- [9 marks]
- d) Write short notes on the three types of drought. [6 marks]

TOTAL MARKS = 40

## SECTION II ANSWER ANY TWO QUESTIONS

## QUESTION 2

- a) One of the factors influencing diurnal temperature patterns is continentality. Marine locations have been observed to display small diurnal temperature ranges, which increase with distance from the large water bodies. Discuss why this is the case. [10 marks]
- b) For the daily solar and temperature rhythms, explain why peak temperature lags behind peak solar radiation as shown in Figure 1. [8 marks]

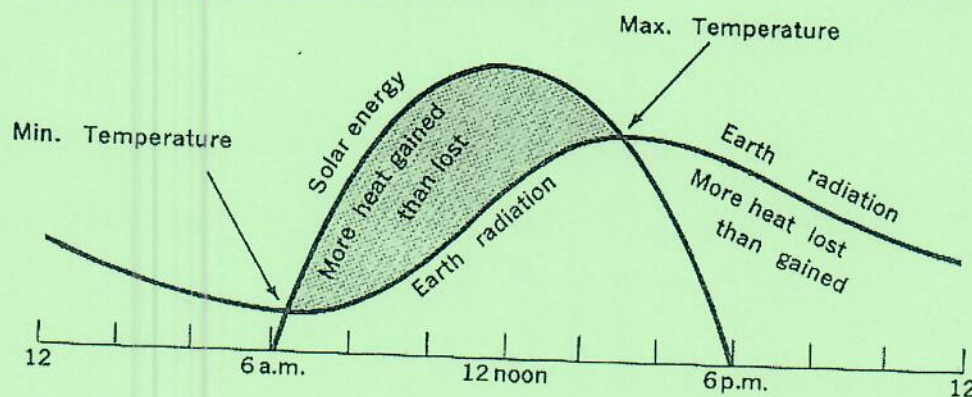


Figure 1: Daily solar and temperature rhythms

- c) How do the following factors affect the soil's thermal diffusivity:
- Soil's organic matter
  - Soil moisture content
  - Size of soil pore
- [12 marks]

**TOTAL MARKS = 30**

**QUESTION 3**

- a) With the aid of a diagram, explain the relationship between air temperature and vapour pressure deficit (VPD).
- [10 marks]
- b) Explain how reference evapotranspiration is determined using the following approaches, also mentioning the advantages and disadvantages of each:
- (i) Blaney-Criddle
  - (ii) Hargreaves
  - (iii) Priestly-Taylor
  - (iv) Penman-Monteith
- [20 marks]

**TOTAL MARKS = 30**

**QUESTION 4**

Write short notes on the following:

- (i) Rayleigh Scattering
  - (ii) Dry adiabatic cooling
  - (iii) Exo-terrestrial solar radiation
  - (iv) Radiative equilibrium
  - (v) Climate change mitigation
  - (vi) Climate change adaptation
- [30 marks]

**TOTAL MARKS = 30**