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UNIVERSITY OF SWAZILAND
RESIT 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;
   i)   Thermal diffusivity in soils
   ii)   Unstable atmospheric conditions   [5 marks]
   iii)   Effective rainfall in agroecosystems   [5 marks]
   iv)   Climate change   [5 marks]
   v)   Bulk surface resistance as a factor for evapotranspiration   [5 marks]
                                                                          [5 marks]

b) The figure below shows the daily solar and temperature rhythm. Notice that the time for highest temperature does not coincide with the time of maximum of solar radiation. Discuss the cause for this lag of temperature.
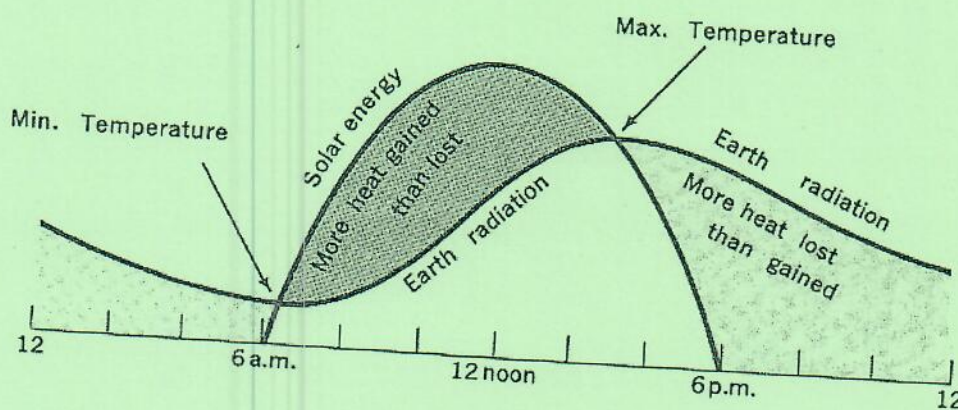
[15 marks]

SECTION II   ANSWER ANY TWO QUESTIONS

QUESTION 2

a)   Explain how the following rain gauges work:

   (i)   Standard non-recording rain gauge   [5 marks]
   (ii)   Weighing bucket rain gauge   [5 marks]
   (iii)   Tipping bucket type   [5 marks]
   (iv)   Float type gauge   [5 marks]

b)   Describe how a Campbell-Stokes Sunshine Recorder works, outlining the advantages and disadvantages of using it to estimate solar irradiance.

                                                                [10 marks]

QUESTION 3

a) Discuss why oceanic (marine) climates have narrow ranges of daily temperature than continental climates.

                                                                [10 marks]

b) The dominant wavelength radiated by an object is 8.0 μm. Estimate the temperature of the object.

                                                                [5 marks]

c) Given the following weather data for a certain day, calculate:
   (i)   Saturation vapour pressure (e_s)   [8 marks]
   (ii)   Actual vapour pressure (e_a)   [5 marks]
   (iii)   Vapour pressure deficit (VPD)   [2 marks]

   Minimum temperature – 14.3 °C
   Maximum temperature – 31.1 °C
   Minimum relative humidity - 52 %
   Maximum relative humidity – 90 %

QUESTION 4

a) Discuss the three types of drought.

[10 marks]

b) Explain what Dependable rainfall is, and discuss at least one method that is used to determine the dependable rainfall of a particular area.

[10 marks]

c) The surface energy balance is generally explained with the equation:

$$R_n = H + LE + G$$

Where R_n is the net radiation, H is the sensible heat flux, LE is the latent heat flux and G is the soil heat flux. Explain each of the components and the surface conditions that determine the proportion of each.

[10 marks]

Useful Equations

$$e_S = \frac{e^o(T_{max}) + e^o(T_{min})}{2}$$

$$e^o(T) = 0.6108\exp(\frac{17.27T}{T + 237.3})$$

$$e_a = \frac{e^o(T_{min})\frac{RHmax}{100} + e^o(T_{max})\frac{RHmin}{100}}{2}$$