UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME: BSC IN LAND AND WATER MANAGEMENT YEAR 2

COURSE CODE: LUM 201 (NEW PROGRAMME)

TITLE OF PAPER: AGRO CLIMATOLOGY

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS

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QUESTION 1

a) Draw a clearly labelled diagram, showing the way of water in the atmosphere onto and into the ground and back (i.e. the hydrological cycle). **[10 marks]**

b) Explain in detail how a rainfall type of precipitation is formed. **[10 marks]**

c) Using the formulae as given in appendix 1, copy and fill in table 1 below. Using the results, explain the relationship between rainfall observed and the effective portion (%).

Monthly dependable and effective rainfall

Month	Observed (mm)	Effective (mm)	Dependable Effective (mm)	% effective
Jan	149.4			
Feb	126.1			
Mar	88.6			
Apr	51.1			
May	24.1			
Jun	12.4			
Jul	9.8			
Aug	14.4			
Sep	32.8			
Oct	70			
Nov	91.1			
Dec	123.8			
TOTALS				

[20 marks]

QUESTION 2

Explain how these 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) Bulk surface resistance and aerodynamic resistance
iv) Clothesline effect and oasis effect
v) To 'mitigate against' and to 'adapt to' climate change (giving examples)
vi) Effective rainfall and dependable rainfall **[30 marks]**

QUESTION 3

The correct use of well-functioning instruments is important in collecting climate data. Thus any user of an instrument should understand how the instrument operates and most importantly how to read the instrument correctly. Therefore:

i) Describe the functioning of a pyranometer, further explaining the importance of some key components within the instrument. **[5 marks]**

ii) Explain how a Campbell-Stokes sunshine recorder works, stating its advantages and disadvantages. **[5 marks]**

iii) Discuss the proper installation of a raingauge, and give the possible sources of error when using this instrument. **[10 marks]**

iv) Explain how a Stevenson screen looks like, and the rationale of having some instruments housed in it. **[10 marks]**

QUESTION 4

a) The roots of a well watered crop completely covering the ground can take up to 50 – 80 tons of water per hectare per day, depending on the weather conditions. Scientists have all along been confused as to why plants are so 'wasteful' of water.

Explain why each of the functions listed below, and even collectively do not justify such an amount of water being required by the plants. You can add value to your answer by giving estimates of water needed for each process.

- Photosynthesis
- Transport of nutrients from roots to leaves
- Cooling of plant

If the above do not justify such a large use, then why do plants need so much water? **[15 marks]**

b) With the aid of a diagram, discuss the **three** stages of evaporation from a soil surface from the moment just after irrigation or a rainfall event up to when most of the water has been removed from the soil. **[15 marks]**

APPENDIX 1

a) USDA Soil Conservation Service Method to determine effective rainfall.

$P_{eff} = P\,(125 - 0.2P)/125$ for P<250mm/month
$P_{eff} = 125 + 0.1P$ for P>250mm/month

b) FAO developed a relationship to estimate dependable effective rainfall from monthly mean rainfall;

$P_{de} = 0.6\,P - 10$ *for P < 70mm*
$P_{de} = 0.8\,P - 24$ *for P > 70mm*