



**UNIVERSITY OF SWAZILAND
MAIN EXAMINATION PAPER**

**PROGRAMME: BSC IN LAND AND WATER MANAGEMENT
YEAR 2**

COURSE CODE: LUM 201

TITLE OF PAPER: AGRO CLIMATOLOGY (NEW PROGRAMME)

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

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

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QUESTION 1

While branded by some as the greatest hoax ever perpetrated on humanity, most scientists now agree that climate change is a reality. Using the outline below, explain the phenomenon of a changing climate.

- The process of solar radiation and the 'greenhouse effect'
- Enhanced 'greenhouse effect' due to human activities
- The impacts of climate change on agriculture
- Mitigation and adaptation
- CO₂ fertilization and its effect on crop productivity and water use efficiency

[40 marks]

QUESTION 2

Briefly discuss the following with regard to energy transfer and distribution.

- i) Lapse rate
- ii) Electromagnetic radiation
- iii) Stefan-Boltzmann law
- iv) Thermal diffusivity
- v) Bowen ratio
- vi) Oasis effect

[30 marks]

QUESTION 3

a) Write and balance an equation for photosynthesis. [5 marks]

b) Explain the 3 stages of the process of photosynthesis, giving the limiting factors for each stage. [15 marks]

c) Discuss the following theories that explain how temperature influences dry matter accumulation in a plant, further discussing their limitations.

- i) Van't Hoff Law
- ii) Degree day concept

[10 marks]

QUESTION 4

- a) Discuss what actual yield is, as opposed to the potential (maximum) yield.
[8 marks]
- b) When using the agro-ecological zone method for calculating potential yield, the following steps are followed.

- Calculation of gross dry matter production of a standard crop
- Correction for crop species and temperature
- Correction for crop development over time and leaf area
- Correction for net dry matter production
- Correction for harvested part

Discuss the significance of each correction, giving examples where possible.

[12 marks]

- c) Crops use less than 1% of their total water requirements in the process of photosynthesis. This means only a small amount of water is required for dry matter production. That being the case, explain how drought conditions impact on the yield of a crop.

[10 marks]