



# **UNIVERSITY OF EMBU**

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**2016/2017 ACADEMIC YEAR**

**FIRST SEMESTER EXAMINATION 2016/2017**

**FOURTH YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE  
IN MANAGEMENT OF AGROECOSYSTEMS AND ENVIRONMENT**

**AEM 401: AGROECOSYSTEM MODELLING**

**DATE: NOVEMBER 29, 2016**

**TIME: 2:00-4:00**

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**INSTRUCTIONS:**

**Answer Question ONE and ANY Other TWO Questions.**

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**QUESTION ONE (30 MARKS)**

- a) Describe the process of phosphorus mineralization in soil (6 marks)
- b) Explain why the pyramid of energy is always upright (6 marks)
- c) Explain why phosphorus gaseous loss is not considered in nutrient balance studies. (6 marks)
- d) State the components of a nutrient model (6 marks)
- e) Explain nutrient enrichment in reference to nutrient modelling. (6 marks)

**QUESTION TWO (20 MARKS)**

- a) Illustrate an energy cycle in a maize monocrop agroecosystem in Embu (10 marks)
  - b) If crop residues were applied as mulch explain the changes in the energy cycle (10 marks)
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**QUESTION THREE (20 MARKS)**

- a) Using an illustration describe the Phosphorus cycle (10 marks)
- b) Explain how cover crops build soil organic carbon (10 marks)

**QUESTION FOUR (20 MARKS)**

Calculate the annual nitrogen and phosphorus budgets of a maize-bean rotation under the following conditions: (20 marks)

- 90 kg DAP applied at planting
- 60 kg N/ha/year in cattle manure
- 50 kg P/ha/year in cattle manure
- 40 kg N/ha/year fixed through Biological Nitrogen fixation
- 45 kg N/ha/year crop uptake
- 45 kg P/ha/year crop uptake
- 45 kg N/ha/year in runoff
- 30 kg P/ha/year in runoff
- Soil pH 7

**QUESTION FIVE (20 MARKS)**

Design a sustainable three year annual crop rotation program for a horticulture farmer in Mbeere, Embu County that would maximise nutrient and energy cycling. (20 marks)

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