



# MACHAKOS UNIVERSITY

University Examinations For 2021/2022 Academic Year

SCHOOL OF ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT

DEPARTMENT OF ENVIRONMENTAL SCIENCES

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF ENVIRONMENTAL SCIENCE

ENS 436: INDUSTRIAL ECOLOGY AND CLEANER PRODUCTION

**DATE:**

**TIME:**

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**INSTRUCTIONS:** Answer Question **ONE** and any other **TWO** Questions

## QUESTION ONE (30 Marks)

- a) Explain the meaning of the following terms
- Industrial ecology (2 marks)
  - Cleaner production (2 marks)
  - Design for environment (2 marks)
- b) Explain how cleaner production contributes to sustainable development. (9 marks)
- c) Using Kalundborg as an example, discuss the concept of industrial symbiosis. (15 marks)

## QUESTION TWO (20 MARKS)

Discuss the concept of cleaner production that can be applied in a cement manufacturing plant and the barriers that may arise during its application.

## QUESTION THREE (20 MARKS)

Discuss the key elements that should be considered in the implementation of Environmental Management System (ISO 14001) for a named industrial plant.

## QUESTION FOUR (20 MARKS)

Explain the objectives of eco-labeling and guiding principles that are critical for an effective and credible eco-labeling programme.

## QUESTION FIVE (20 MARKS)

Using a specific industrial plant, describe the steps you would follow to carry out a waste minimization programme.