



# **KIBABII UNIVERSITY**

**UNIVERSITY EXAMINATIONS  
2021/2022 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER  
MAIN EXAMINATIONS**

**FOR THE DEGREE OF B.SC (RENEWABLE ENERGY AND BIOFUELS  
TECHNOLOGY)**

**COURSE CODE:** REN 324

**COURSE TITLE:** BIOENERGY II

**DATE:** 01/09/2022

**TIME:** 9:00AM-11:00AM

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## **INSTRUCTIONS TO CANDIDATES**

TIME: 2 Hours

**Answer question ONE and any TWO of the remaining**

KIBU observes ZERO tolerance to examination cheating

### Question One (Compulsory)

- a) Define (3 marks)
- i) Biomass
  - ii) Biofuel
  - iii) Bioenergy
- b) Enumerate FIVE biomass properties that should be considered for the choice of conversion process. (5 marks)
- c) Giving examples classify biomass feedstock used for the gasification process. (3 marks)
- d) State FIVE factors affecting the gasification process. (5 marks)
- e) Define wood-burning efficiency and highlight FIVE factors one must consider when selecting a wood burner. (5 marks)
- f) Briefly describe FOUR wood stoves designs. (4 marks)
- g) Describe the process of cogeneration, giving its advantages and disadvantages. (5 marks)

### Question Two

- a) Give the salient characteristics of the gasification process over other bio-conversion methods. (6 marks)
- b) With the aid of a well labelled diagram, describe the working of the fixed bed down draught gasifier. (8 marks)
- c) State the chemistry of the gasification process in details. (6 marks)

### Question Three

- a) Distinguish between pyrolysis and torrefaction. (2 marks)
- b) Clearly explain FIVE types of pyrolysis reactors that have been commercially developed. (10 marks)
- c) Briefly describe the torrefaction process and highlight FIVE advantages of the torrefaction process. (8 marks)

#### Question Four

- a) A major goal for any stove design is to get more heat into the pot (improve fuel efficiency). As an upcoming stove design expert, discuss how to improve the fuel efficiency being developed by a villager in Bungoma County. (10 marks)
- b) Bungoma County community-based group would like to design a specific stove for household use. Discuss ten principles the group need to be conversant with before beginning the design process. (10 marks)

#### Question Five

- a) Briefly explain the principle of cogeneration and its necessity in power plant systems. (4 marks)
- b) Clearly distinguish between the topping and bottoming cycle cogeneration technologies. (6 marks)
- c) Kabras sugar company intends to install a bagasse-based cogeneration plant. As the project engineer, explain any FOUR factors that you would consider for the choice of cogeneration technology to be used. (8 marks)