UNIVERSITY OF
KWAZULU-NATAL

INYUVESI
YAKWAZULU-NATALI

SCHOOL OF ENGINEERING

MAIN EXAMINATIONS: JUNE 2023

COURSE AND CODE: BIOREFINERY CONCEPTS AND GREEN TECHNOLOGIES ENCH4BG

DURATION: 2 HOURS

TOTAL MARKS: 100

INTERNAL EXAMINERS: Dr. N. M. Mkhize

INTERNAL MODERATOR: Prof. K Moodley

EXTERNAL MODERATOR: Prof. K. Harding

INSTRUCTIONS:

1. **ALL** questions should be attempted.
2. Any programmable or non-programmable calculator may be used provided it has been cleared of any information that would subvert the purpose of the examination.
3. Calculations must be shown in sufficient detail to illustrate your understanding of the procedure.
4. **Submit the question paper with the answer book.**
5. This examination paper, together with all associated diagrams **MUST BE HANDED IN TOGETHER WITH YOUR SCRIPT.**

Student Number:

QUESTION 1

Chemical leasing

1.1. What is chemical leasing? (2)

1.2. Using three examples, explain applications of chemical leasing. (10)

1.3. Name 2 advantages and 2 disadvantages of chemical leasing. (8)

TOTAL /20/

QUESTION 2

Biogas from cow dung

2.1. What does biogas from cow dung mainly comprise of? (4)

2.2. Name four (4) factors that affect biogas production from cow dung. Elaborate how each factor affects biogas yield. (8)

2.3. Which conversion system is biogas production categorised with? List and describe at least two biogas production steps. (4)

2.4. List two advantages of biogas production. (4)

TOTAL /20/

QUESTION 3

Fats and Oils in the Chemical Industry

3.1. Name 5 typical feedstock sources for fats and oils, and 5 products from fats/oils. (5)

3.2. Discuss 5 advantages and 5 disadvantages when using fats/oils for industrial applications. (5)

3.3. Describe the process of making soap with a flow scheme, and indicate what happens at each of the 5 main stages. (10)

TOTAL /20/

QUESTION 4

Biofuels

4.1. In terms of the production of biofuels, how does the thermochemical treatment differ from the biological treatment? What are advantages for each treatment method? (4)

4.2. Name and define two out of the three-thermochemical routes that are mainly used to extract energy from biomass. List at least two advantages of each method. (6)

4.3. What is a hydro-deoxygenation process? Name at least one feedstock used in this process. (4)

4.4. Name three types of biomass characterisation methods. (3)

4.5. What are the typical components of each characterisation from Question 4.4.? (3)

Lewonene

TOTAL /20/

QUESTION 5

Green Chemistry

5.1. Define Green Chemistry? (4)

5.2. What are the main sources of agricultural and forestry waste? Provide four (4) examples for each. (8)

5.3. List four principles of green chemistry and two examples for each. (8)

TOTAL /20/