

University of Ruhuna- Faculty of Technology

Bachelor of Biosystems Technology Honours Degree

Level 2 (Semester I) Examination, July 2023

Academic year 2020/2021

Course Unit: BST 2142 - Bioenergy Systems (Written)

Duration: 1.5 hours

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- This paper contains **two parts** (A and B)
 - Answer **ALL QUESTIONS** in Part A in the given space and **TWO QUESTIONS** from Part B in the separate booklet.

Part A - ANSWER ALL QUESTIONS

1. Fill in the blanks by selecting answers from the list given below. (30 Marks)

(TEMPERATURE, SYNGAS, FERMENTATION, GASIFICATION, PYROLYSIS, FEED STOCK BIOGAS, ELECTERICITY, PRESSURE, BIOGENIC MATERIAL).

Biomass is biological material derived from living or recently living organisms. When energy is derived from such material, it is called Bioenergy. It is mostly used for the generation of i....., heat and to produce fuels. Wood and wood processing wastes, Agricultural crops, and waste materials, ii. and Animal manure and human sewage could be considered as main sources of bioenergy. Typical processes used for bioenergy generation are Pyrolysis, Gasification, Direct Combustion, Anaerobic Digestion and iii.....

The result of biomass being digested anaerobically, is known as iv..... When biomass or any carbonaceous material is converted into carbon monoxide, hydrogen, and carbon dioxide, that process is called v..... where the main output is called vi..... When the biomass is exposed to high temperature in an environment with no oxygen, it is called vii..... The output consists of solids, liquids, and gases. However, the composition or the proportion of these outputs depends mainly on, viii....., ix..... and x.....

Although bioenergy generation has been identified as an environmentally friendly and sustainable approach, there has always been arguments with regard to agriculture for food or agriculture for energy.

2. i. How would you define the process called "Combustion" in bioenergy generation? (6 Marks)

ii. What are the three (3) main stages of combustion process? (9 Marks)

3. During 2021 and 2022 fuel crisis, there were long ques in gas stations for petrol and diesel. As a result, the people began to store this fuel. Addressing this issue, assume that you were able to produce biodiesel from non-edible vegetable oils and stored in two barrels labeled as follows.

Barrel One – B100

Barrel Two – B20

i. What do you understand by this B factor? (6 Marks)

ii. Which barrel is not suitable to store for a long period of time? Explain why? (10 Marks)

4. i. Mention three advantages and three disadvantages of biodiesel. (12 Marks)

- ii. There are many raw materials that could be used for biodiesel production. Yet, many are arguing that using microalgae would be the best solution. Do you agree or disagree, explain briefly? (20 Marks)

- iii. Indicate the major byproduct of the biodiesel production and one importance of it. (7 Marks)

Major by product:

Importance:.....

5. i. List four (4) major sources of Biomass. Give one example for each. (16 Marks)

Major Source	Example

- ii. Categorize fuels according to their physical properties. Give two example for each. (18 Marks)

Fuel category	Examples

iii. State suitable conditions/range of following factors affecting for methane formation. (9 marks)

Factor	Condition/Range
pH	
Temperature	
C:N ratio	

6.

i. State three (3) characteristics of a good fuel. (9 Marks)

ii. Define calorific value? (6 Marks)

iii. Differentiate Flash point and Fire point. (12 Marks)

Flash point	Fire point

7.

i. Complete the following table with relevant details. (18 Marks)

Type of Pyrolysis	Major Product
a.	d.
b.	e.
c.	f.

ii. List **three** (3) different types of pyrolyzers.

(12 marks)

@@@@@@ End of Part A @@@@@@

Part B – ANSWER TWO QUESTIONS ONLY

Question 1.

- i. Considering a faculty canteen, briefly discuss the importance of establishing a biogas unit at the canteen premises. (40 marks)
- ii. Explain the process of bio-digestion of a biogas plant with a suitable diagram. (60 marks)

Question 2

- i. Briefly discuss the factors deciding the type of pyrolyser classification. (40 Marks)
- ii. Explain the difference between slowest and average speed pyrolysis. (60 Marks)

Question 3

Write short notes on the followings.

- I. Advantages of gasification over combustion. (50 marks)
- II. Plasma Gasifiers. (50 marks)

@@@@@@ End of Part B @@@@@@