



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**FOURTH YEAR SECOND SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS**

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWBLE
ENERGY AND BIOFUELS TECHNOLOGY**

COURSE CODE: IET 423

COURSE TITLE: SUSTAINABLE ARCHITECTURE

DURATION: 2 HOURS

DATE: 18/1/2022

TIME: 8-10AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 2 printed pages. Please Turn Over



QUESTION 1 (30 marks)

- a. Define the following terms:
 - i. Sustainable Architecture. (1 mark)
 - ii. Energy conservation. (1 mark)
 - iii. Azimuth angle. (1 mark)
 - iv. Solar altitude angle. (1 mark)
 - v. Zenith angle. (1 mark)
- b. Explain any five (5) examples of bioenergy applications. (5 marks)
- c. State any five (5) passive solar design principles. (5 marks)
- d. Calculate the power in a wind moving with speed $u = 6 \text{ ms}^{-1}$ incident on a wind turbine with blades of 80 m diameter. How does the power change if the wind speed increases to $u = 12 \text{ ms}^{-1}$. Assume the density of air is 1.2 kgm^{-3} . (5 marks)
- e. State any five (5) categories of heat exchangers in industrial heat recovery systems. (5 marks)
- f. State any five (5) key BedZED principles. (5 marks)

QUESTION 2 (20 marks)

- a. Explain what is contained in a microCHP system and how it works. (5 marks)
- b. State the steps that are followed when reading the Sun position from a Cylindrical Diagrams sun-path diagram. (5 marks)
- c. Describe how a ground source heat pumps works. (10 marks)

QUESTION 3 (20 marks)

- a. State any five (5) broad categories of energy efficiency measures as recommended by energy audits. (5 marks)
- b. Explain any five (5) advantages of passive solar design. (5 marks)
- c. List any five (5) BREEAM & Eco homes design aspects and their aim. (10 marks)

QUESTION 4 (20 marks)

- a. Direct sunlight of average intensity 300 Wm^{-2} is incident normal on a solar cell. The area of the cell is 0.2 m^2 . What is the total incident energy in one day in kWh? How is this total energy altered if the sunlight falls at an angle of 20° to the normal to the surface of the cell? (5 marks)
- b. Explain any five (5) ways of home energy efficiency. (5 marks)
- c. Discuss any five (5) sustainable building techniques. (10 marks)

QUESTION 5 (20 marks)

- a. Describe the two main categories of generators. (6 marks)
- b. Describe how a MicroCHP Stirling engine operates. (4 marks)
- c. Describe how Rammed earth and cob structures are constructed. (10 marks)