KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER
MAIN 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: 4/10/2021 **TIME: 8:00-10:00AM**

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. Energy Efficiency (1 mark)
   ii. Fuel cell (1 mark)
   iii. Thermal mass (1 mark)
   iv. Heat exchanger (1 mark)
   v. EcoHomes (1 mark)

b. Describe any five (5) Renewable energy Technologies. (5 marks)

c. Explain any five (5) ways of home energy efficiency. (5 marks)

d. Calculate the power in a wind moving with speed u = 10 ms^{-1} incident on a wind turbine with blades of 60 m diameter. How does the power change if the wind speed increases to u = 20ms^{-1}. Assume the density of air is 1.2 kgm^{-3}. (5 marks)

e. Direct sunlight of average intensity 200Wm^{-2} is incident normal on a solar cell. The area of the cell is 0.3 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 30^0 to the normal to the surface of the cell? (5 marks)

f. State any five (5) Sustainable Building Techniques. (5 marks)

QUESTION 2 (20 marks)

a. Describe any five (5) passive solar design principles. (5 marks)

b. Explain any five (5) advantages of passive solar design. (5 marks)

c. State any three (3) factors that cause the change in sun paths. (3 marks)

d. State the steps followed to read the Sun position from a stereographic sun-path diagram. (7 marks)

QUESTION 3 (20 marks)

a. Explain how a heat pump operates. (6 marks)

b. Describe the two main categories of generators. (6 marks)

c. Describe how a MicroCHP Stirling engine operates. (4 marks)

d. State the equipment that comprise an air reticulation system. (4 marks)

QUESTION 4 (20 marks)

a. State any three (3) factors that determine thermal mass. (3 marks)

b. State any Seven (7) broad categories of energy efficiency measures as recommended by energy audits. (7 marks)

c. Describe any five (5) categories of heat exchangers in industrial heat recovery systems. (10 marks)

QUESTION 5 (20 marks)

a. Describe how Rammed earth and cob structures are constructed. (10 marks)

b. List any five (5) BREEAM & Eco homes design aspects and their aim. (10 marks)