KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF RENEWABLE ENERGY

COURSE CODE: **REN 415**

COURSE TITLE: **ENERGY STORAGE TECHNOLOGY**

DATE: 17/04/2023 **TIME: 9:00-11:00AM**

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

Section A-Compulsory (30 marks)

QUESTION ONE

a) Define the term energy storage? (1mk)

b) What do you understand by the term Phase Change Materials as used in energy storage? (2mks)

c) As a consultant in energy in energy storage technology. Briefly give FOUR justifications why energy storage is needed in Kibabii University (4mks)

d)

i. Discuss any THREE types of electric grids in terms of voltage as used in electricity transmission and distribution. (3mks)

ii. Give the reasons why energy from electricity is transmitted in extra high voltage from the power plant (2mks)

e) State THREE types of loads as used in energy storage concept. (3mks)

f) Briefly explain how energy storage concept helps in achieving the following? (4mks)

i. Integration of diverse resources.

ii. Reduction of environmental pollution

g) State THREE ways in which energy storage capacity of a fly wheel can be increased (3mks)

h) Name the equipments used in the following energy conversion (4mks)

i. Mechanical to Electrical generators

ii. Light to Electrical pv cell

iii. Chemical to Electrical fuel cell

iv. Thermal to Mechanical steam turbine

i) Give TWO advantages of electric powered vehicles over diesel powered vehicles. (2mks)

j) State the main differences between batteries and fuel cells (2mks)

Section B –Answer any Two Questions (40marks)

QUESTION TWO

a. **Using well labelled diagram, describe the working operation of:**
   i. Pumped hydro energy storage methods. (**9mks)**
   ii. Flywheel energy storage (5mks)

b. **Describe the industrial applications for the following energy storage techniques.**
   i. Flywheel **(2mks)**
   ii. Pumped water storage system. (**2mks).**
   iii. Fuel cell **(2mks)**

QUESTION THREE

a. Using a well labelled schematic diagram, describe Compressed Air Energy Storage (CAES) method. (10 mks).
b. With the aid of a well labelled diagram, describe the working principle of a fuel cell as an energy storage device. (10mks)

QUESTION FOUR

a. A householder sticks a shiny silver coated sheet of plastic bubble wrap on the wall behind the radiator in the lounge in order to save energy. Explain how this can reduce heat loss from the lounge by conduction, convection and radiation. [6 marks].
b. Differentiate between Energy transmission and energy distribution as used in electricity **(4mks.)**
c. **Give two factors that determine the choice of energy transportation mode (2mks).**
d. Hydrogen technology can be the solution to the current energy crisis in transport sector. Give explanations in support or opposing this statement. **(4mks).**
e. Support or oppose the following statement "Energy conservation is our best and cheapest source of energy we have." (**3 mks**).