



KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWABLE
ENERGY AND BIO FUELS TECHNOLOGY

COURSE CODE: REN 311

COURSE TITLE: Solar Energy 1

DURATION: 2 HOURS

DATE: 19/12/2022

TIME: 2:00-4:00PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other **TWO (2)** Question.
- 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 3 printed pages. Please Turn Over



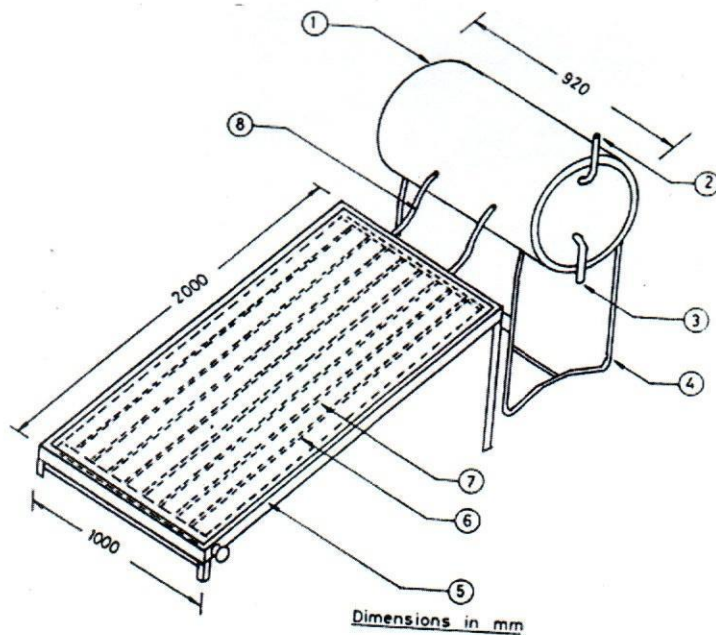
KIBU observes ZERO tolerance to examination cheating

Question One

- (a) List THREE ways in which sun's energy has been used traditionally [3 Marks]
- (b) Explain any FIVE factors one needs to consider for using solar energy [5 Marks]
- (c) Solar thermal collectors heavily rely on principles of heat transfer for their operation. Illustrate this with reference to:
- i Flat plate collector solar water heat [2 Marks]
 - ii Solar oven [2 Marks]
- (d) Explain briefly how electricity is produced 24/7 in a concentrating solar plant (CSP) [5 Marks]
- (e) Compare and contrast solar energy with one other type of renewable energy in terms of relative advantages and disadvantages. [5 Marks]
- (f) Distinguish between energy and power and give examples of each, including specific units of measurement that might be used for each. [5 Marks]
- (g) What is the main rationale for detailed market analysis in solar energy field today? [5 Marks]

Question Two

- (a) In full sunlight, how much solar energy is impinging on the array? [1 Mark]
- (b) If it can be converted to electricity at 20% efficiency, how much electric power is generated? [1 Mark]
- (c) After this electricity is used, what becomes of the energy? Give at least two examples, for example, if the electricity is used for lighting or for running a scientific instrument. [2 Marks]
- (d) On earth, a commercial solar array of the same size won't do as well in generating electricity. Give at least two reasons why not. [2 Marks]
- (e) The figure below shows a domestic water heater. Label the parts indicated [4 Marks]



- (f) With the aid of sketches describe the construction and operation of evacuated tube water heater [10 Marks]

Question Three

- (a) Describe the available and developing thermal fluids used in solar thermal energy systems [10Marks]
- (b) There are seven key properties of a thermal fluid for solar application that must be understood before engaging in design work or decision-making regarding thermal fluid performance and/or selection. Explain these properties. [10Marks]

Question Four

- (a) Drying is a very important process in crop farming. Explain this with reference to three processes you are personally familiar with [9 Marks]
- (b) (i) With the aid of sketches, describe the construction and operation of a tunnel dryer [9 Marks]
- (ii) Explain challenges encountered while using solar dryers [2 Marks]

Question Five

- In the year 2035, Kenya is considering adding OTEC and CSP to its green energy mix. You are leading a team of consultants to study the feasibility of these two technologies. Provide details of factors you will consider [20 Marks]