UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET		
COURSE CODE	:	BET 4043
COURSE	:	RENEWABLE ENERGY
SEMESTER / SESSION	:	02 - 2023/2024
DURATION	:	3 HOURS

Instructions:

1. This booklet contains **4** question sets. Answer **ALL**.
2. All answers should be written in the answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hand and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Name **one (1)** radioactive material. (1 mark)

b) Illustrate using suitable diagrams and descriptions the followings nuclear reactions.

i. Nuclear fission. (4 marks)

ii. Nuclear fusion. (4 marks)

c) A security guard house is equipped with the following electrical appliances together with their utilization hours.

- One 18 Watt fluorescent lamp with electronic ballast (utilized for 12 hours per day)
- One 75 Watt ceiling fan (utilized for 24 hours per day)
- One 100 Watt refrigerator (runs 24 hours per day, compressor: 12 hours ON, 12 hours OFF).

The guard house is going to be powered by 12 Vdc, 250 Wp solar PV modules. Showing all calculations;

i. Determine the total energy used per day by the electrical appliances. (3 marks)

ii. Determine the PV modules total energy requirement per day. (3 marks)

iii. Determine the number of PV modules required. (3 marks)

d) Explain wind power. (3 marks)

QUESTION 2

a) Illustrate using suitable diagrams and descriptions how wind is made. (6 marks)

b) Explain geothermal gradient. (3 marks)

c) Explain the listed environmental effects of the geothermal electricity power station.

i. Toxic chemicals. (3 marks)

ii. Adverse land stability effect. (3 marks)

d) Illustrate using suitable diagrams and descriptions the stand-alone *PV* + *Wind* + *Generator* energy system. (6 marks)

QUESTION 3

a) State any **three (3)** types of batteries used with renewable energy systems. (3 marks)

b) State the **four (4)** types of bacteria used to breakdown waste in an anaerobic digester. (4 marks)

c) Explain the concerns regarding the biogas digester systems. (5 marks)

d) Illustrate using suitable diagrams and descriptions the **three (3)** production method of bioethanol. (9 marks)

QUESTION 4

a) Describe the blend of biodiesel. (5 marks)

b) Explain the problems of biodiesel utilization. (4 marks)

c) Illustrate using suitable diagrams and descriptions the conventional method of electrical energy production. (6 marks)

d) Name any **two (2)** types of fuel cell. (2 mark)

----------End of Questions----------

Formula Sheet

Solar PV System Sizing
Power Consumption Demand
1. Calculate total Watt-hours per day for each appliance used. Add the Watt-hours needed for all appliances together to get the total Watt-hours per day which must be delivered to the appliances. 2. Calculate total Watt-hours per day needed from the PV modules. Multiply the total appliances Watt-hours per day times **1.3** (the energy lost in the system) to get the total Watt-hours per day which must be provided by the panels.
PV Modules Sizing
1. Calculate the total Watt-peak rating needed for PV modules. • Divide the total Watt-hours per day needed from the PV modules by **3.43** (PV maodule generation factor) to get the total Watt-peak rating needed for the PV panels needed to operate the appliances. 2. Calculate the number of PV panels for the system. • Divide the answer obtained in item 2.1 by the rated output Watt-peak of the PV modules available to you. • Increase any fractional part of result to the next highest full number and that will be the number of PV modules required.
Inverter Sizing
Inverter size should be ***25%-30% bigger than total Watts of appliances***.