UNIVERSITY COLLEGE TATI

## UNIVERSITY COLLEGE TATI (UC TATI)

| FINAL EXAMINATION QUESTION BOOKLET | | |
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| COURSE CODE | : | BET 4043 |
| COURSE | : | RENEWABLE ENERGY |
| SEMESTER / SESSION | : | 02 - 2024/2025 (PERDANA & ANJAL) |
| 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 nuclear decay of uranium-238 using suitable diagrams and descriptions. (8 marks)

c) A traffic monitoring outpost is equipped with the following electrical appliances together with their utilization hours.

- Two (2) 15 Watt lamps (utilized for 12 hours per day)
- One (1) 60 Watt fan (utilized for 24 hours per day)
- One (1) 100 Watt refrigerator (runs 24 hours per day, compressor: 12 hours ON, 12 hours OFF).

The outpost is going to be powered by 12 Vdc, 300 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 how wind is made using suitable diagrams and descriptions. (6 marks)

b) Explain geothermal gradient. (3 marks)

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

i. Adverse land stability effect. (3 marks)

ii. Toxic chemicals. (3 marks)

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

**QUESTION 3**

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

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

**QUESTION 4**

a) Explain biodiesel blends. (5 marks)

b) Explain biodiesel utilization problems. (4 marks)

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

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

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

## Formula Sheet

| Solar PV System Sizing |
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| **Power Consumption Demand** |
| 1. Calculate total Watt-hours per day for each appliance used.<br>Add the Watt-hours needed for all appliances together to get the total Watt-hours per day which must be delivered to the appliances.<br>2. Calculate total Watt-hours per day needed from the PV modules.<br>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.<br>• 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.<br>2. Calculate the number of PV panels for the system.<br>• Divide the answer obtained in item 2.1 by the rated output Watt-peak of the PV modules available to you.<br>• 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***. |