ELIZADE UNIVERSITY ILARA MOKIN, ONDO STATE

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE TITLE: RENEWABLE ENERGY

COURSE CODE: EEE 425

EXAMINATION DATE: 0 FEBRUARY, 2020

COURSE LECTURER: DR O. K. OGIDAN

HOD's Signature

TIME ALLOWED: 2 HOURS

INSTRUCTIONS

a. ANSWER QUESTION ONE (1) ANY OTHER THREE (3) QUESTIONS.

b. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.

c. YOU ARE NOT ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

Question 1 [25marks]

a.) i.) What do you understand by renewable energy? (2 marks)

ii.) Mention three (3) sources of non-renewable energy sources and three (3) sources of renewable energy sources (3 marks)

b.) Briefly explain the difference between grid connected and standalone solar system, include diagram where necessary (5 marks)

c.)

i.) What do you understand by the term "global warming"? (2 marks)

ii.) Recent market survey reveals a sales-drift from incandescent bulb to the energy saving bulbs. Give three (3) reasons for this paradigm shift or change in behaviour (3 marks)

d.) Given the equipment possessed by a household in the Table 1 as well as the solar PV specification. You have been contracted to design an efficient solar energy system for the household. Show in a detail form how the following parameters are determined:

i.) The total energy demand (if all equipment are to work for the hours specified in the table 1) (2 marks)

ii.) The number of solar PVs (assuming a 200W PV, 12 Volts) (2 marks)

iii.) The inverter size (2 marks)

iv.) The number of deep cycle batteries (assuming each battery is 200Ah) (2 marks)

v.) The capacity of charge controller (2 marks)

Table 1: Table showing the appliances to be used by the household, quantity and rating

Appliances	Rating (watt)	Power factor	Power demand (VA)	Hour	Energy demand (Watt-hour)
1 decoders (at 15W each)	15	1	15	8	?
1 LCD/LED TV	60	1	6	8	?
2 Laptop computer	70	1	70	5	?
1 Deep freezer	200	0.8	250	8	?
5 Energy saving bulbs (at 15W each)	75	1	75	4	?
2 phone chargers (at 10 W each)	20	1	20	3	?
Total	440		485		?

PV specification is given as:

| Pmax, Voc, Isc, Vmp and Imp tested at Normal Operating Cell Temperature (NOCT) defined as irradiance of 800W/m²; 45±3C; Wind speed 1m/s. Power tolerance of +/- 3% refers to measured performance. | Maximum Power (P_{max}) = 137W – 140W

 Open Circuit Voltage (V_{oc}) = 41.2V – 41.4V

 Short Circuit Current (I_{sc}) = 4.68A – 4.74A

 Maximum Power Voltage (V_{mp}) = 32.2V – 32.4V |

Question 2 [14 marks]

a.) With the aid of well labelled diagram, briefly discuss five (5) renewable energy sources

(10 marks)

b.) Explain the basic principle by which a solar PV works, include a diagram where necessary

(4 marks)

Question 3 [12marks]

a.) What do you understand by the term "biomass"? (3 marks)

b.) What do you understand by the term balance of system (BOS) (2 marks)

b.) Explain the process of converting biomass to biofuel (7 marks)

Question 4 [12marks]

a.) What do you understand by the term smart grid? (2 marks)

b.) All over the world, there is the paradigm shift from fossil fuel to renewable energy sources. What do you think is responsible for this new focus on renewable energy? (5 marks)

c.) What do you consider as the demerits of biomass as an energy source? (5 marks)

Question 5 [12marks]

a.) What do you understand by the term climate change? (2 marks)

b.) What are the causes of climate change? (3 marks)

c.) What are the effects of climate change? (4 marks)

d.) What do we do to mitigate climate change effects? (3 marks)

Question 6 [11marks]

a.) Define the following terms as they relate with solar energy (5 marks)

    i.   Solar intensity
    ii.   Irradiance
    iii.   Solar irradiation
    iv.   Solar potential
    v.   Peak sun hour

b.) Discuss the two major ways by which energy from the sun can be harnessed for man's use (2 marks)

c.) Mention four (4) of the major devices to be used in the installation and their functions (4 marks)