SOLAR ENERGY SOURCES

SECTION A [40 MARKS]

Attempt **ALL** the Questions in this Section.

SECTION A I

For questions 1 to 10, write the correct alternative in the answer booklet provided. **(2 marks @)**

1. Which among the following is the cleanest form of energy

   A. Nuclear power B. Natural gas C. Fossil fuels D. Solar energy

2. Choose the correct answer: Solar energy is a

   A. Renewable energy B. Non-renewable energy

3. Trapping the sun's energy without using any mechanical devices is known as

   A. Concentrating solar power B. Solar thermal energy
   C. Active solar energy D. Passive solar energy

4. Which is the non-mechanical device that converts sunlight directly into electricity?

   A. Thermometer B. Voltmeter C. Photovoltaic cell D. Barometer

5. Choose YES or No: Solar energy can be stored in batteries.

   A. YES B. NO

6. Identify the best location for the inverter from the list.
   A. Inside a sealed box B. Outside and exposed to sunshine
   C. Near to, but not directly above, the battery D. On the battery

7. Which one out of the following is a potential safety hazard?
   A. A flat roof with a sound structure B. A car parked underneath
   C. The roof is rusted. D. A small tree shading the roof

8. A DC load is connected to 24 V and the current is 2 A. What is the power of the load?
   A. 24 W B. 48 W C. 12 W D. 26 W

9. What is the risk when connecting batteries together?
   A. The voltage is increasing. B. There is current going into the batteries.
   C. Someone might short the terminals. D. The batteries might fall over.

10. How should a lead acid battery bank be installed?
    A. In a battery box inside a building with the ventilation outlet at the highest point on the box to the inside of the building...

B. In a dedicated room with the with the ventilation outlet vented to the outside at the highest point in the room.
C. In a dedicated room with the with the ventilation outlet vented to the outside at the lowest point in the room
D. Any of the above

SECTION A II

11. Define solar thermal energy. **(1 mark)**
12. List **three** disadvantages of solar energy. **(3 marks)**
13. List **two** types of solar energy. **(2 marks)**
14. Outline **two** uses of solar energy. **(2 marks)**
15. Name at least **two** applications of solar energy. **(2 marks)**
16. Name any renewable energy systems. **(1 mark)**
17. Explain Payback time and compensation schemes **(2 marks)**
18. Explain Semi fixed costs and operating costs **(2 marks)**

SECTION B (60 MARKS)

Question 1

a) Define a term photovoltaic **(2 marks)**
b) With the aid of a diagram explain photovoltaic effect **(6 marks)**
c) Why is the configuration of photovoltaic cell made in either series or parallel **(2 marks)**
d) Which components in a PV system are responsible for the following illustrate using a diagram **(8 marks)**
   i) Conduction
   ii) Control
   iii) Distribution
   iv) Storage
   v) Conversion
e) What are the **two** major principle classification of photovoltaic system? **(2 marks)**

Question 2

a) Define a solar cell **(2 marks)**
b) With the aid of a diagram briefly explain how a solar cell generates charges from the sun **(6 marks)**
c) Outline the three functions of a solar cell **(3 marks)**
d) State five major factors that affect solar cell performance **(5 marks)**
e) Briefly explain the four major future developments in solar cell industry **(4 marks)**

Question 3

a) Explain at least **five** major steps taken while planning a PV system installation **(5 marks)**
b) List **five** major wiring guidelines when connecting PV system **(5 marks)**
c) Outline **five** functions of charge controller **(5 marks)**
d) Explain **two** limitations of solar PV systems **(2 marks)**
e) Give three precautions taken while planning a PV installation **(3 marks)**

Question 4

A Lamp Or appliance	B Voltage (Volts)	C Power (Watts)	D Daily use (hours)	E Daily Energy use (Watt Hours)
Living room Lamp	12	14	3	42
Kitchen	12	14	2	28
Bedroom 1	12	8	2	16
Bedroom 2	12	8	2	16
Radio	12	10	3	30
14" Color TV	12	100	3	300
TOTAL DAILY LOAD ENERGY DEMAND				432

Given the customer loads as in the above table, System voltage is 12, Insolation value is 5.3h

System Storage days 3days; DOD 50%

Calculate **(20 marks)**

a) Total load requirements
b) required battery capacity
c) Inverter size
d) Size of solar module

Question 5

a) What are the characteristics of the tariffs **(5 marks)**
b) Describe the types of tariff **(4 marks)**
c) The local government of Mayuge District seeks to set up a PV system. Please advice on the consideration for the choice of PV system. **(6 marks)**
d) What determines the PV mounting selection? **(5 marks)**