

## TEST ON SOLAR ENERGY SEMESTER 2

### Ques

- 1) Define the following as applied to solar energy.
  - (i) Direct radiation (2mks)
  - (ii) Diffuse radiation (2mks)
  - (iii) Solar irradiance (2mks)

(b) Outline four factors that affect solar radiation (3mks)

(c) With the aid of a diagram explain the operation of the solar cell (07mks)

(d) Explain three effects of shade on the solar module performance (04mks)

### Questions

(a) Define solar hybrid system (03mks)

(b) Outline three advantages and three disadvantages of a hybrid photovoltaic thermal system (06mks)

(c) With the aid of a well labelled block diagram, explain the operation of a solar photovoltaic wind hybrid power generating system (08mks)

(d) Write down four factors considered when selecting a site for a hybrid photovoltaic diesel generator battery generator (4mks)

### Questions

(a) Outline four factors you would consider for the site selection of a solar water pump (04mks)

(b) State 5 advantages of solar water pumps (05mks)

(c) Draw a well labelled block diagram of solar water pumping system (07mks)

## Q&A

- \* Define (i) Global solar radiation  
    (ii) solar energy  
    (iii) solar array.
- (a) Define global solar radiation  
(b) Explain why solar medium is non-conducting  
(c) Explain why solar medium is non-polar and non-conducting
- (b) State three advantages and three disadvantages of electric power (06mks)
- (c) Explain two forms in which solar energy can be converted (06)  
(d) With the aid of a diagram, explain the construction of a stand-alone direct coupled PV system.
- (a) State four major components of solar water heater (04).  
(b) Explain five applications of solar energy (10mks)  
(c) Describe the operation of solar water heating unit (06).
- (a) Explain three types of solar cells (06)  
(b) Draw a schematic representation of solar energy (06mks)  
(c) Describe how solar electric power is generated (08)
- (a) Define the term hybrid system as applied to solar energy (02)  
(b) State three advantages and disadvantages of using a charge controller in hybrid (16)

name plate and explain the meaning of each parameter (08mks)

(d) Explain why solar modules are normally connected in parallel (04).

Question V

(a) Define global warming (02)

(b) Explain four predicted effects of global warming in Uganda (08)

(c) Suggest four possible solutions of global warming (04).

(d) Explain how the green house gases cause global warming (06marks).

(e) Differentiate b/w solar tracking and solar incident angle (04)

(f) With the aid of a diagram, show how direct and diffuse radiation react on the earth surface (06)

Question VI

It is important to observe high safety standards while working on solar electric systems. As an experienced technician, execute the safety precautions you will observe while handling or installing;

(i) Solar batteries (04)

(ii) Solar modules (04)

(b) You have been tasked to install a solar PV system of solar battery, charge controller, solar module and bulb.

(i) Draw a block diagram for this system (06).

(ii) Explain the sequential steps you will follow to install the system.

Question

Table 1 shows the load requirements of a solar PV system for an experienced technician.

Calculate the;

- (i) Daily energy demand for the system in WH (05)
- (ii) Daily energy requirement for the system in WH (04)
- (iii) Daily system charge in AH (02)
- (iv) Size of the module in Watts (03)
- (v) Size of the charge controller in Amperes (02).
- (vi) Size of battery in AH (04)

Assume:

- System power losses = 15%
- Peak sun hours = 5.
- System voltage = 12V d.c
- System efficiency = 90%
- Number of storage days = 2.
- Battery depth of discharge = 75% and only d.c loads are considered.

Loads	Power(watts)	Quantity	Daily WD (W.H)
Fluorescent lamps	4	5	3
Energy saver lamps	5	2	8
Phone charging	5	1	2
Coffered TV 22"	60	1	3

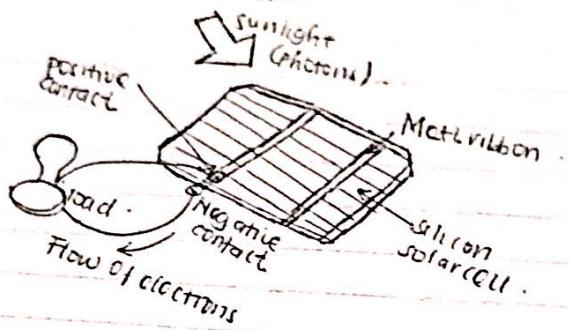
Explain the  
functions of the following subsections

Factors influencing energy payback

- Panel efficiency
- Manufacturing process
- system life span
- Installation and maintenance

Solar energy

Solar electricity is the direct conversion of sunlight to electricity. When a solar cell is converted into electric energy. This occurs according to principle of photoelectric effect.



### How solar cells work.

(a) State the factors that lead to poor performance of the photovoltaic system.

(b) Benefits of solar energy

### Environmental benefits of solar energy

Zero greenhouse gas emissions during operation.

Reduced air and water pollution.

Conservation of natural resources.

Land use efficiency

Minimal noise pollution.

### Environmental impacts of solar energy

-Green house effect.

-land use and habitat disruption.

-Waste generation.

-Timeline impact.

### Energy payback times

Refers to the time it takes for the solar panel system to generate the same amount of energy it consumed during its own installation and disposal.

### Functions of energy payback

= Environmental impact assessment

- Investment analysis

# Electrical Principles

Level IV

Process  
An emulsion  
dissolution  
which results in mixing  
of liquid  
and solid

## Solar Electric System

Solar electricity is the electric power generated from the sun light using devices called solar cell modules.

Solar electric system is based on;

① Low voltage DC, net 240V AC

② It stores power in batteries

③ Power is generated on site by photo-voltaic equipment (PV)

④ For system to be economical, energy produced must be used efficiently.

### Applications of solar electric power

- Used for street lighting

- Used for road sign illumination

- Used in protection of pipelines from corrosion

- Providing power for household lights

- Applied in health centres for vaccine refrigeration and lighting

- Water pumping

### Merits of solar electric power

- They consume no fuel.

- They produce electricity without giving off exhaust fumes.

- Compared to conventional generator, electric systems require very little maintenance.

Properly installed solar electric systems are safe.

- They are economical for many applications.

### Demerits

- Solar electric systems require batteries for energy storage which must be carefully maintained.

- Appliances and lamps which run on low voltage are not easily available as these run on main power.

- There is lack of trained technicians to design and install solar electric systems.

- The initial cost of solar electrical systems is high by rural standards for people to raise cash to buy the system at once.

### Definitions

Solar cell modules: These are arrangements of many solar cells in series, sealed in glass and plastic and supported inside a metal frame.

Photovoltaic device (PV): A device which converts light energy into electrical energy.

### Array

Is an assembly of several modules on a support structure together with associated wiring.

### Solar radiations

Is the measure of solar the solar energy received on a specific area over a specified period of time.

### Direct radiation

Is the type of radiation which comes in a straight beam and can be focused with a lens or mirror.

### Diffuse radiation

Is the type of radiation reflected by atmosphere or scattered by the clouds or dust.

### Global radiation

Refers to the combination of diffuse and direct solar radiation arriving on a surface.

### Solar irradiance

Is the solar radiation actually striking the surface or the power received per unit area from the sun in watts per square meter ( $\text{W/m}^2$ ).

### Irradiation

Is the measure of solar energy received on a specific area over a specified period of time.

### Solar constant

Is the radiation which arrives at the edge of the earth's atmosphere at the rate of about  $1350 \text{ W/m}^2$ .

### A crystal

This is the regular geometrical state taken up by elements in a condenser.

### Peak sun hours:

These are number of hrs per day during which solar irradiance is  $1000 \text{ W/m}^2$  at the site.