DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

19EE711 SOLAR AND WIND ENERGY

UNIT III-SOLAR RESOURCE

PV Modules and Arrays:

PV Modules: An individual cell produces about one watt of power at about 0.5 V and they are of no practical use. Typically, it is a few square inches in size. Hence the basic building block for PV applications is a module consisting of a number of pre−wired cells in series, all encased in tough, weather−resistant packages in an area of several square feet. Such an encased panel is called a Solar Module.

Most solar PV panels have 30 to 36 cells connected in series. Each cell produces about 0.5 V in sunlight, so a panel produces 15V to 18 V. These panels are designed to charge 12−V batteries. A 30−cell panel (15 V) can be used to charge the battery without a controller, but it may fail to charge the battery completely.

A 36−cell panel (18 V) will do better, but needs a controller to prevent overcharging.

The current depends on the size of each cell, and the solar radiation intensity. Most cells produce a current of 2 A to 3 A in bright sunlight.

The current is the same in every cell because the cells are connected in series.

For cells wired in series, their voltages at any given current add. A typical module will have 36 cells.

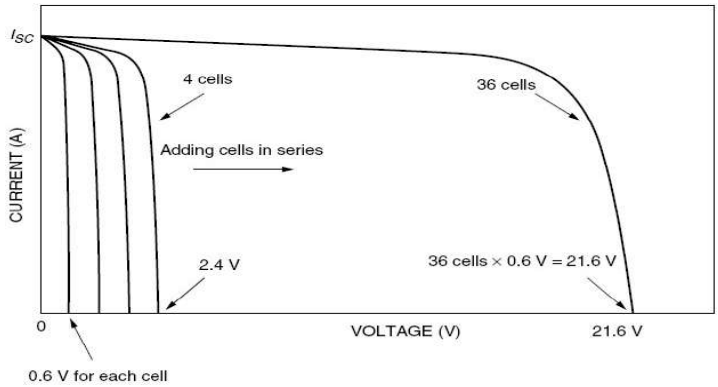

Figure-11: For cells wired in series, their voltages at any given current add. A typical module will have 36 cells.

Arrays: Multiple modules, in turn, can be wired in series to increase voltage and in parallel to increase current, the product of which is power.

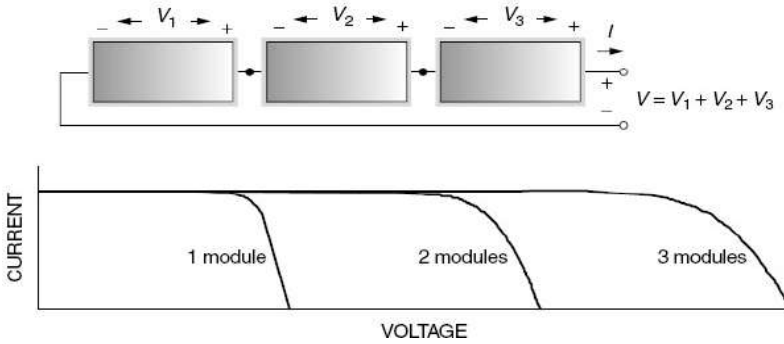

Figure-12: Modules in series, at any given current the voltages add

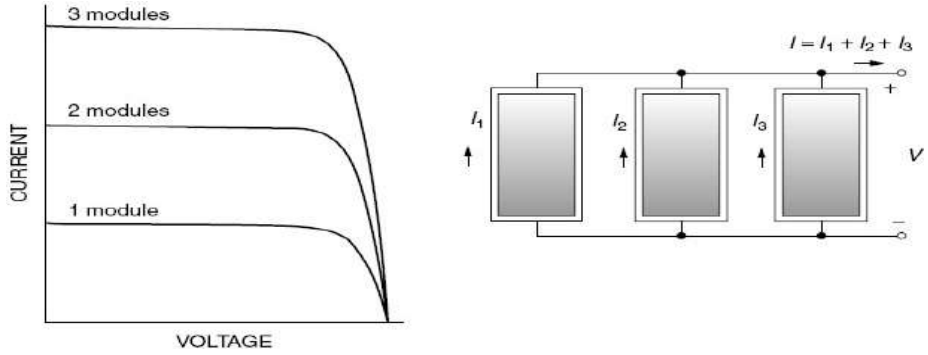

Figure-13: Modules in parallel, at any given voltage the currents add.

An important aspect in PV system design is deciding how many modules should be connected in series and how many in parallel to deliver the required energy. Such combinations of modules are referred to as an ***array*.** Figure below shows this distinction between cells, modules, and arrays.

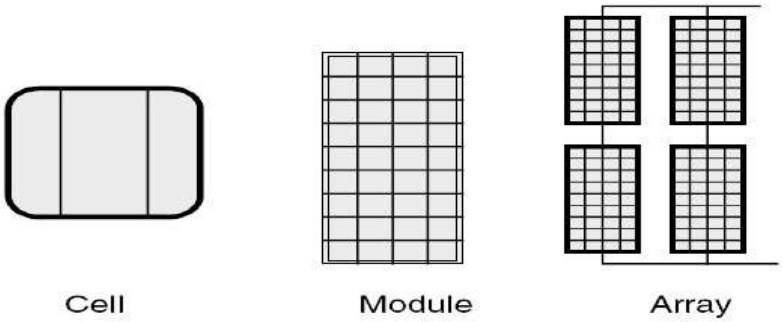

Figure-14: Photovoltaic cells, modules, and arrays

Material in this portion is for information only. Not part of syllabus.

Figure below shows the actual construction of a module in a frame that can be mounted on a structure.

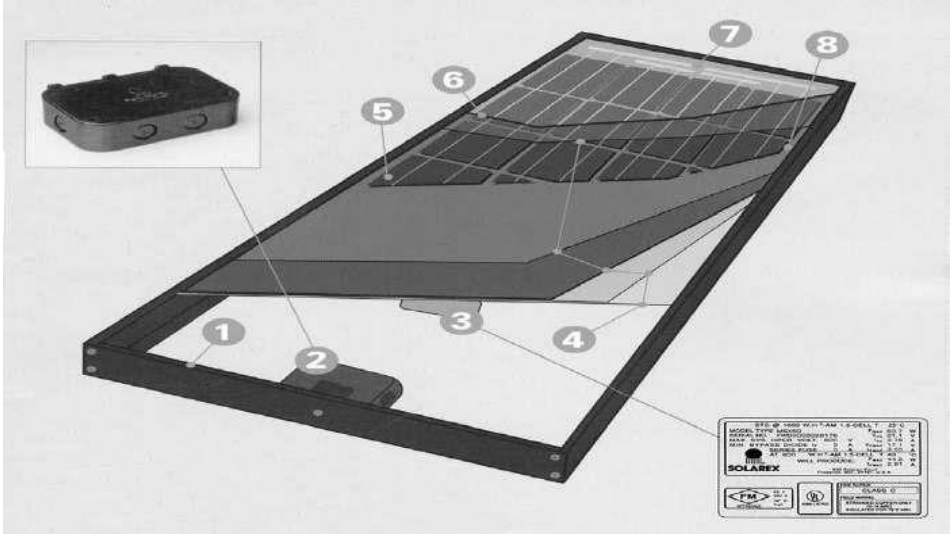

Figure-15: Construction of pv module in Frame : 1) frame, 2) weatherproof junction box, 3) rating plate, 4) weather protection 5) PV cell, 6) tempered high transmissivity cover glass, 7) outside electrical bus, 8) frame clearance.

Mounting of the Modules:

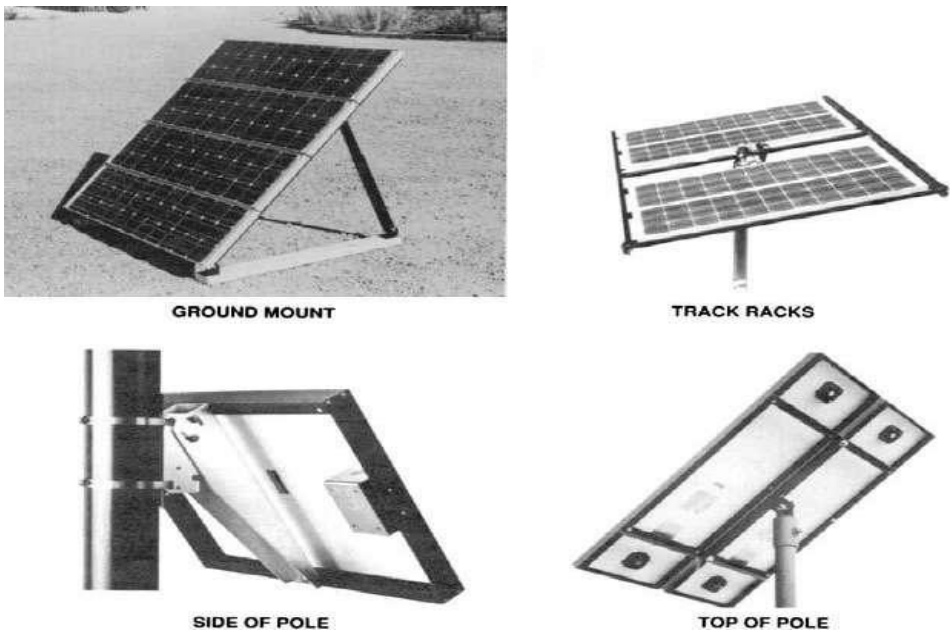

Figure-16: PV module mounting methods