Photo voltaic (elective course 4)

4th year electric power Department

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Dr. Jehan Shazly.

2 - C

$$I_{cell} = I_p - I_o\left(e^{\frac{qV}{kT}} - 1\right)$$

SC $\rightarrow$ $V = 0$ $\quad I_{s.c} = I_p = 2A$

O.C $\rightarrow$ $I_{cell} = 0$ $\quad V_{o.c} = \frac{kT}{q}\ln\left(\frac{I_p}{I_o}\right) = 0.675V$

$$f.f = \frac{P_{max}}{I_{s.c} \times V_{o.c}} = \frac{1}{0.675 * 2} = 0.74$$

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3 - C

$$T_0 + T_1 + T_2 = 0.25\,T$$

$$T_o = T_1$$

$$V_o = V_{rms} = V_{dc}\left[\frac{T_1}{T} + \frac{4T_2}{T}\right]^{1/2}$$

$$220 = 250\left[\frac{T_1 + 4T_2}{T}\right]^{1/2}$$

$$2T_1 + T_2 = 0.25T$$

$$T_1 = \frac{0.25T - T_2}{2}$$

$$220 = 250\left[\frac{\frac{0.25T - T_2}{2} + 4T_2}{T}\right]^{1/2}$$

$$\left(\frac{22}{25}\right)^2 T = \frac{0.25T}{2} + \frac{8T_2 - T_2}{2}$$

$$0.7744\,T - \frac{0.25}{2}T = \frac{7}{2}T_2$$

$$T_2 = 0.185\,T$$

4-C

$$T_{C_1} = T_A + \left(\frac{NOTC - 20}{5.8}\right) G$$

$$= 30 + \left(\frac{35 - 20}{0.8}\right) 0.96 = 48\ ^{\circ}C$$

$$\Delta T_C = 55 - 48 = 7\ ^{\circ}C$$

$$\Delta V_{o.c} = 34 \times 7^{\circ}C \times \left(-2.3 \frac{mV}{^{\circ}C}\right) = -0.5474$$

$$V_{oc_2} = 34 \times 0.5 - 0.5474 = 16.45V$$

(5)

$$HP = 3.66\times10^{-6}\frac{(LPD)\cdot h}{PT\cdot PTF*\eta} = 3.66\times10^{-6}\frac{5000\times525}{5*1.2*0.28}$$

$$= 0.6405 \quad HP$$

$h = 1.05\times50m = 52.m$

use 0.75 Hp motor with 24 V dc

array size

$$\text{The array current o/p} = \frac{0.75HP\times746}{24V*0.9} = 25.9A$$

$$\text{The array o/p volt} = \frac{24V}{0.9} = 26.66V$$

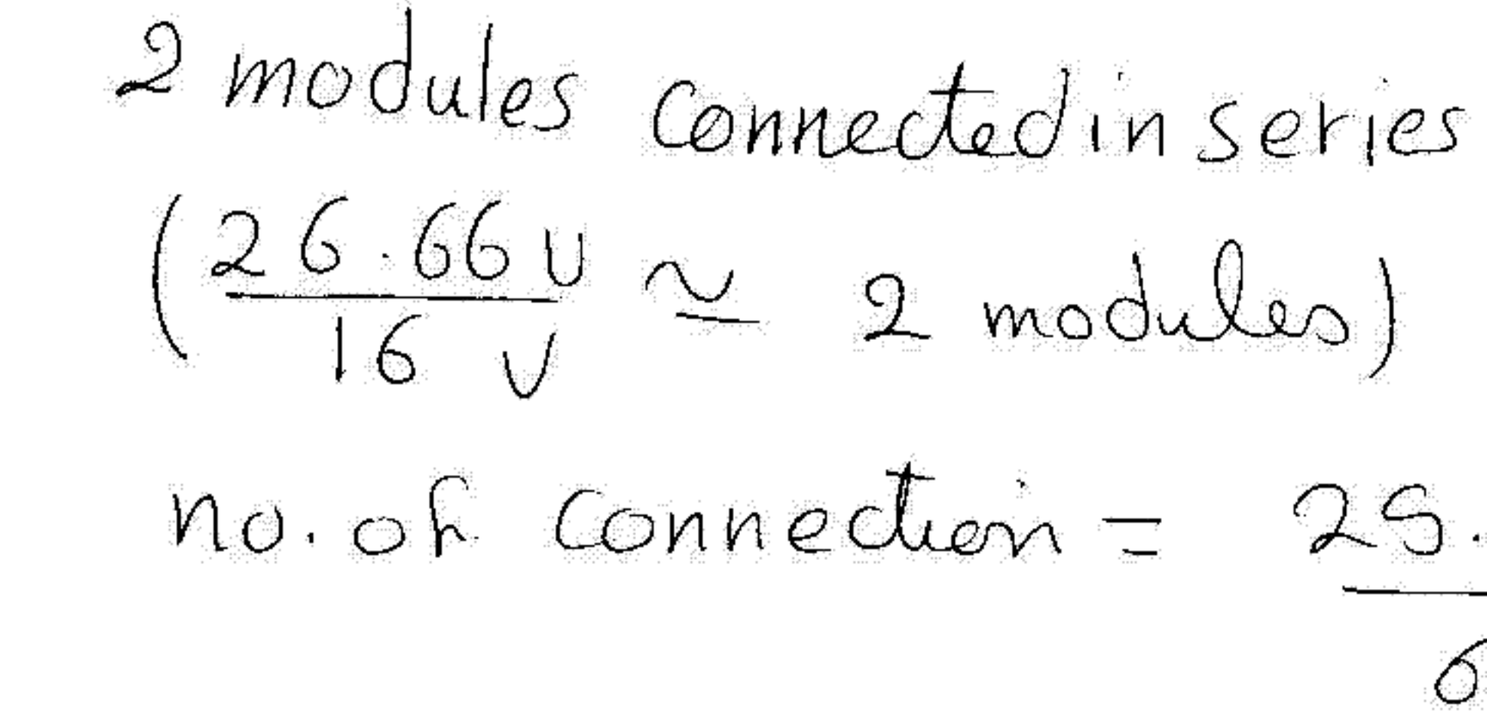
the avilable modules are 16V, 6A

2 modules connected in series for 26.66V

$\left(\frac{26.66V}{16V} \simeq 2 \text{ modules}\right)$

$$\text{no. of connection} = \frac{25.9A}{6A} \cong 5$$

5 parallel sets of 2 inseries



(6) Size the battery dependon winter

$$q' = \frac{\left(\frac{12\,W}{12\,V}\right) * 15h}{0.9 \times 0.97} = 17.18\,Ah$$

the battery Capacity = $\frac{17.18Ah \times 3days}{0.8} = 64.4A$

the airlable batteries are 12V, 48Ah

$$\frac{64.4\,Ah}{48\,Ah} \simeq 2$$

- use 2 batteries Connected in parallel.

Size the PV array

the PV o/p Cussent = $\frac{17.18\,Ah}{0.9 * 4h} = 4.77\,A$

the pv o/p volt = $\frac{12V}{0.9} \simeq 15V$

use one module min 4.77 A, 15V

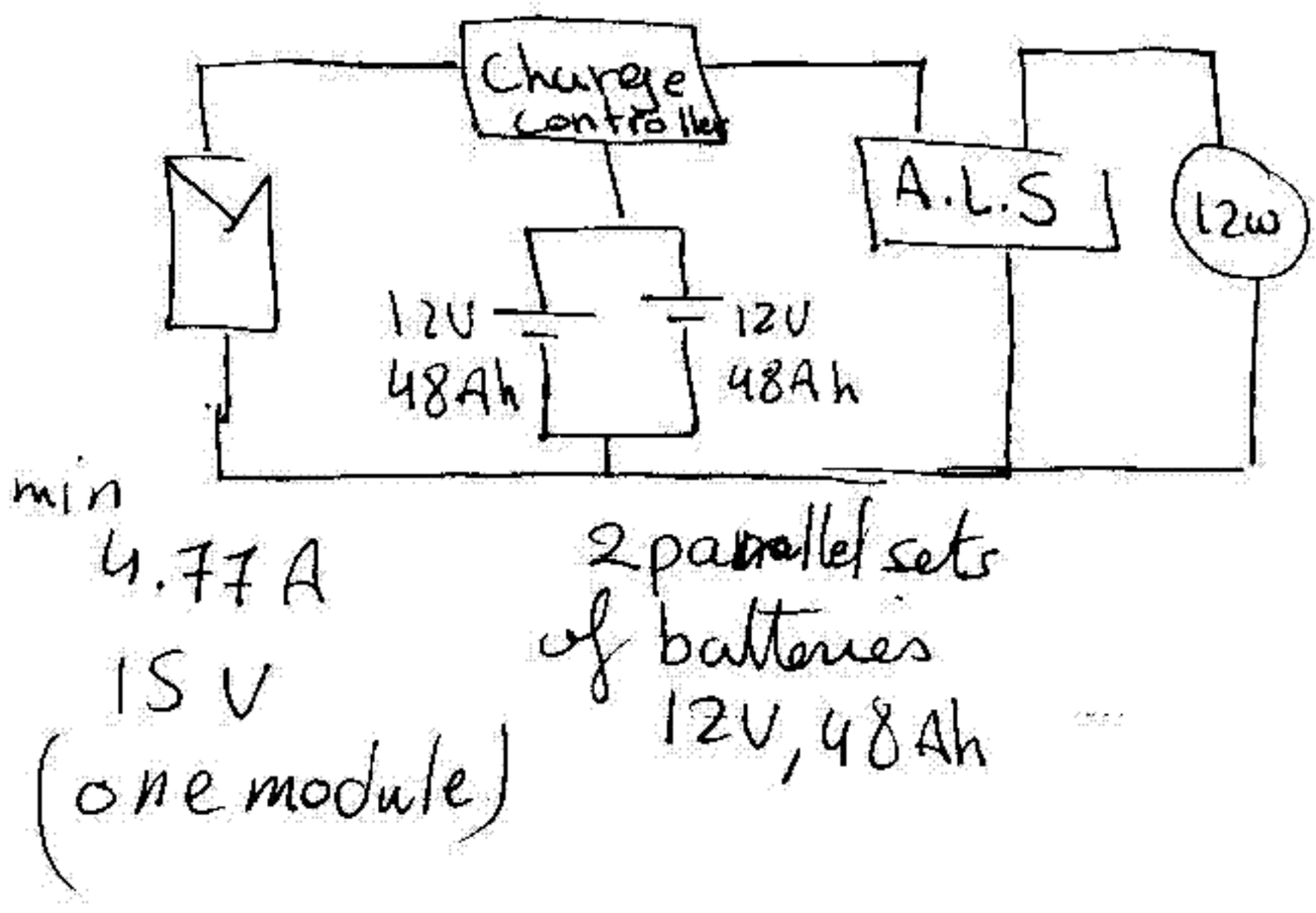
Summer performance

$$q' = \frac{1 * 9h}{0.9 \times 0.97} = 10.3\ Ah$$

The pv o/p current insumer = 4.77A * 6h * 0.9 = 26.7Ah

the access perday = 26.7 - 10.3 = 16.4 Ah

so Charge Controller must be used


Charge controller
A.L.S
12ω
12V
48Ah
12V
48Ah
min
4.77A
15V
(one module)
2 parallel sets of batteries
12V, 48Ah