

## 2. Photovoltaic panels (35 points)

The datasheet for the Shell SQ85-P photovoltaic panels used in lab are appended to the end of this exam.

Suppose that Shell Solar manufactures a new 54-cell PV panel using the same type of cells as in our lab SQ-85's. All 54 cells are connected in series, and there are three backplane (bypass) diodes.

- (a) Determine the following nameplate data for the new 54-cell panels at  $1000 \text{ W/m}^2$  and  $25 \text{ }^\circ\text{C}$

Open-circuit voltage =

Short-circuit current =

Peak power voltage =

Peak power current =

- (b) At  $400 \text{ W/m}^2$  solar irradiance and  $25 \text{ }^\circ\text{C}$ , estimate the following:

Open-circuit voltage =

Short-circuit current =

Power at maximum power point =

- (c) The panel now operates with  $1000 \text{ W/m}^2$  solar irradiance. One cell is shaded and operates with  $400 \text{ W/m}^2$ . Estimate the following:

Open-circuit voltage =

Short-circuit current =

Voltage at maximum power point =

Current at maximum power point =

Power at maximum power point =