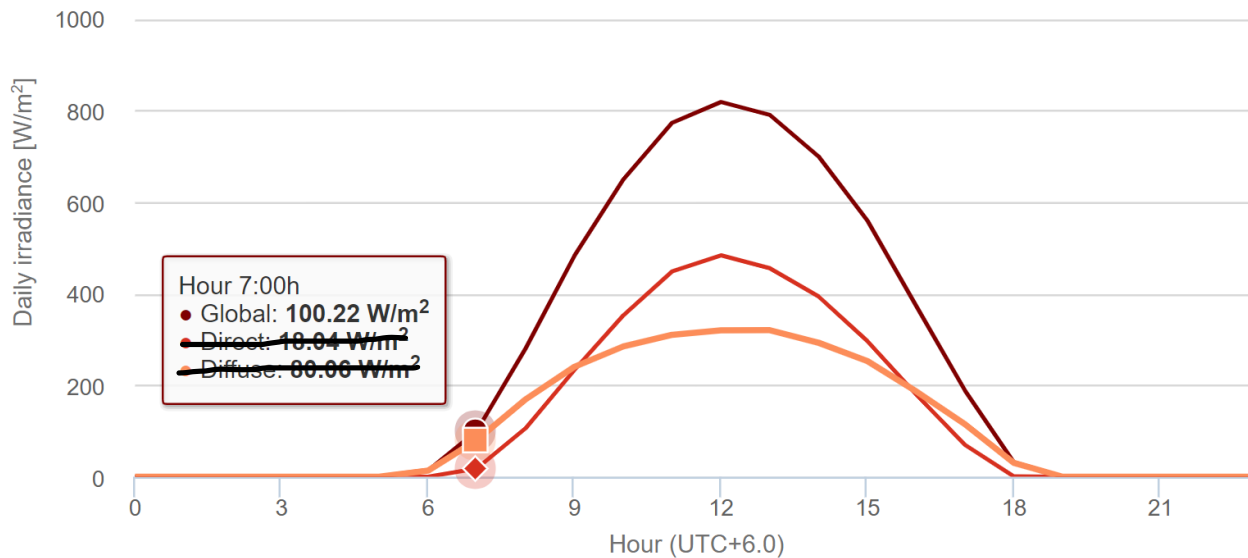


- ✓ No washroom breaks. Phones must be turned off. Using/carrying any notes during the exam is not allowed.
- ✓ At the end of the exam, the **exam script** must be returned to the invigilator.
- ✓ Marks allotted for each question are mentioned beside each question.
- ✓ Write your answers inside the indicated boxes (where applicable). If you run out of room for an answer, please continue-on the back of the page".
- ✓ Symbols have their usual meanings.

Question 1:

10 Marks

[CO3]



The above figure shows the variation of daily average solar irradiance (in units of W/m^2) throughout the day in Bangladesh. In the legend, we can see that at **7:00h**, the (**global**) solar irradiance is about **100.85 W/m^2**

A photodetector module that produces a voltage V_S across its terminal as per the following relation, is used to convert (**global**) solar irradiance G (in units of kW/m^2) to usable voltage.

$$V_S(G) = 6G^2 + 12G + 2$$

You are asked to **design** a circuit using Op-Amp that will be connected to a street-lamp (or an LED) and that will turn the lamp (LED) **OFF** after **7:00h**. The lamp (LED) turns **ON** at **5 V**, and remains **OFF** at **0 V**.

- i. Determine whether the Op-Amp comparator circuit needed will be in inverting, or non-inverting configuration. 2
- ii. Determine the **threshold (reference) voltage** with which the input voltage is compared. 4
- iii. Draw the completed Op-Amp comparator circuit and draw its voltage transfer characteristics curve. 4