Chapter: 7

Conclusion
7.1 Conclusions of the thesis:

One the basis of the entire work discussed in thesis, I would like to draw the following conclusions:

- First of all, a detailed analytical study on the photo-generated excess minority carrier distribution profile and the spectral response of Schottky-barrier silicon solar cells has been carried out in Chapter 2. It has been observed that both of these two parameters are highly dependent on the back surface recombination velocity. It is also observed that there is a substantial fall in the spectral response for the higher value of the doping concentration and the back surface recombination velocity. From these observations it has been concluded that using back surface field the spectral response of the SBSC may be increased. A new design of back surface field Schottky-barrier solar cell has been proposed.

- In Chapter 3 a detailed theoretical study on the back surface field Schottky-barrier solar cells (BSF SBSC) has been carried out. From the results of the study it has been observed that the BSF SBSC gives much improved spectral response than the normal SBSC, having back ohmic contacts.

- A detailed analytical study on the MIS solar cells has been performed in Chapter 4. From the theoretical analysis it has been observed that the conversion efficiency of the MIS solar cells can be increased with the increase in the interfacial layer width as well as with the decrease in the back surface recombination velocity. It is also observed that with the increase in the doping concentration of the n-type silicon base region the conversion efficiency increases. Suitable explanations have been given for the obtained results.

- Finally, the performances of the AlGaAs/GaAs quantum well solar cells (QWSC) have been investigated in Chapter 5 and Chapter 6.

In Chapter 5, the temperature dependence of the three current components i.e. tunneling current, thermionic emission current and the photo-generated current in the n-type base region has been studied using a rectangular barrier model. It is observed that the first two current components and the total current are highly dependent on
temperature of the QWSC. An explanation has also been given for this temperature
dependence of the current components.

In Chapter 6, a theoretical work has been carried out for an AlGaAs/GaAs
multiple quantum well solar cell, assuming the barriers generated in the MQW region are
trapezoidal in nature. The variation of the tunneling current with temperature and
wavelength of the incident photon flux has been studied. It is observed that with the
increase in temperature the tunneling current decreases and with the increase in the
wavelength of the incident photon flux the tunneling current initially increases, but after
a certain wavelength it decreases. A suitable explanation has been given for the results
obtained from the theoretical study. A comparison between the experimental results
obtained from the published literature and the theoretical results from this model has
been performed. From these studies it is observed that the theoretical results are very
close to the experimental results.

7.2 Suggestion for the future works:

From the theoretical work presented in this thesis, some suggestions may be given for the future
research works:

- The conversion efficiency and fill factor for the BSF SBSC may be compared
  with the normal SBSC with back ohmic contacts.
- Experimental work can be performed on SBSCs and BSF SBSCs to satisfy the
  theoretical works carried out in this thesis.
- The variation of the spectral response of the MIS solar cells may be studied.
- In this thesis it has been shown that there may be three types of current
  components of a QWSC. From this theoretical analysis the quantum efficiency of
  the QWSC may be calculated and can be compared with the experimental results.