## List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1</td>
<td>Classification of solar cell</td>
<td>2</td>
</tr>
<tr>
<td>Figure 1.2</td>
<td>Basic diagram of Photoelectric effect</td>
<td>4</td>
</tr>
<tr>
<td>Figure 1.3</td>
<td>Representation of solar array</td>
<td>5</td>
</tr>
<tr>
<td>Figure 1.4 (a)</td>
<td>Equivalent circuit of solar cell</td>
<td>5</td>
</tr>
<tr>
<td>Figure 1.4 (b)</td>
<td>Symbol of solar cell</td>
<td>6</td>
</tr>
<tr>
<td>Figure 1.5</td>
<td>I-V characteristics of illuminated PV cell</td>
<td>7</td>
</tr>
<tr>
<td>Figure 1.6</td>
<td>Power diagram</td>
<td>8</td>
</tr>
<tr>
<td>Figure 1.7(a)</td>
<td>Effect of temperature on I-V characteristics</td>
<td>10</td>
</tr>
<tr>
<td>Figure 1.7(b)</td>
<td>Effect of series resistance</td>
<td>11</td>
</tr>
<tr>
<td>Figure 1.7(c)</td>
<td>Effect of shunt resistance</td>
<td>11</td>
</tr>
<tr>
<td>Figure 1.8</td>
<td>Modes of heat transfer</td>
<td>13</td>
</tr>
<tr>
<td>Figure 1.9</td>
<td>Classification of PV module</td>
<td>22</td>
</tr>
<tr>
<td>Figure 4.1:</td>
<td>Schematic diagram of opaque PV module having air duct below PV module</td>
<td>40</td>
</tr>
<tr>
<td>Figure 4.2:</td>
<td>Schematic diagram of semitransparent PV module having duct below PV module</td>
<td>41</td>
</tr>
<tr>
<td>Figure 4.3:</td>
<td>Schematic diagram of opaque PV module having air duct above the module</td>
<td>42</td>
</tr>
<tr>
<td>Figure 4.4:</td>
<td>Schematic diagram of semitransparent PV module having air duct above the module</td>
<td>42</td>
</tr>
<tr>
<td>Figure 5.1:</td>
<td>An elemental length dx indicating stream example of air</td>
<td>45</td>
</tr>
<tr>
<td>Figure 5.2 (a):</td>
<td>Cross-section view of opaque PV module having duct below the module</td>
<td>46</td>
</tr>
<tr>
<td>Figure 5.2 (b):</td>
<td>Energy flow diagram</td>
<td>46</td>
</tr>
<tr>
<td>Figure 5.3 (a):</td>
<td>Cross-section view of opaque PV module having air duct above the module</td>
<td>49</td>
</tr>
<tr>
<td>Figure 5.3 (b):</td>
<td>Energy flow diagram</td>
<td>50</td>
</tr>
<tr>
<td>Figure 5.4 (a):</td>
<td>Cross-section view of semitransparent PV module having air duct below PV module</td>
<td>53</td>
</tr>
<tr>
<td>Figure 5.4 (b):</td>
<td>Energy flow diagram</td>
<td>54</td>
</tr>
<tr>
<td>Figure 5.5 (a):</td>
<td>Cross-section view of semitransparent PV module having air duct above the module</td>
<td>56</td>
</tr>
<tr>
<td>Figure 5.5 (b):</td>
<td>Energy flow diagram</td>
<td>57</td>
</tr>
<tr>
<td>Figure 5.6 (a):</td>
<td>Schematic diagram of hybrid PVT solar dryer</td>
<td>61</td>
</tr>
<tr>
<td>Figure 5.6 (b):</td>
<td>Cross-section view of solar dryer partially covered with PV module</td>
<td>61</td>
</tr>
<tr>
<td>Figure 5.7 (a):</td>
<td>Conventional cash flow diagram for life cycle cost of PVT system without considering effect of EPBT</td>
<td>71</td>
</tr>
<tr>
<td>Figure 5.7 (b):</td>
<td>Conventional cash flow diagram for life cycle cost of PVT system considering effect of EPBT</td>
<td>72</td>
</tr>
<tr>
<td>Figure 5.7 (c):</td>
<td>Conventional cash flow diagram for life cycle cost of PVT system considering effect of EPBT &amp; carbon credit</td>
<td>73</td>
</tr>
<tr>
<td>Figure 7.1 (a):</td>
<td>Variation of solar intensity and ambient temperature with time for the month of May for 'a' type weather condition for Bangalore city</td>
<td>82</td>
</tr>
<tr>
<td>Figure 7.1 (b):</td>
<td>Variation of electrical efficiency &amp; solar cell temperature with time for the month of May for 'a' type weather condition for Bangalore city</td>
<td>83</td>
</tr>
<tr>
<td>Figure 7.2 (a):</td>
<td>Monthly variation of overall thermal energy gain by considering a-d type weather condition for Bangalore city</td>
<td>84</td>
</tr>
</tbody>
</table>
Figure 7.2 (b) : Monthly variation of overall exergy gain by considering a-d type weather condition for Bangalore city

Figure 7.3: Monthly variation of overall exergy efficiency by considering a-d type weather condition for Bangalore city

Figure 7.4 (a) : Correlation diagram on the premise of yearly overall thermal energy gain by looking into a-d type climate condition

Figure 7.4 (b) : Correlation diagram on the premise of yearly overall exergy gain by looking into a-d type climate condition

Figure 7.5 : Monthly variation of overall exergy efficiency by considering ‘a’ type weather condition for different cities of India.

Figure 7.6 (a) : Influence of various flow rate on outlet air temperature of ‘a’ type weather condition for month of May of Bangalore city

Figure 7.6 (b) : Influence of various flow rate on electrical efficiency of ‘a’ type weather condition for month of May of Bangalore city

Figure 7.7 : Variation of outlet air temperature with time for the month of January for 'a' type weather condition for four different cities

Figure 7.8 : Variation of solar cell temperature with time for the month of January for 'a' type weather condition for four different cities

Figure 7.9 (a) : Hourly variation of electrical efficiency for the month of January for ‘a’ type weather condition of four different cities
Figure 7.9 (b) : Hourly variation of electrical efficiency for type a, b, c, d weather condition of Srinagar city

Figure 7.9 (c) : Monthly variation of daily average of electrical efficiency for a, b, c, d type weather condition of Srinagar city

Figure 7.10 (a) : Monthly variation of overall thermal energy gain considering ‘a’ type weather condition for four different cities of India.

Figure 7.10 (b) : Hourly variation of overall exergy gain considering ‘a’ type weather condition for four different cities of India

Figure 7.11 : Variation of instantaneous efficiency for Bangalore city for ‘a’ type weather condition

Figure 7.12 : Hourly variation of electrical, thermal & overall efficiency of 'a' type weather condition of month of May of Bangalore city

Figure 7.13 : Influence of variation in length of collector on overall thermal efficiency of ‘a’ type weather condition for month of May of Bangalore city

Figure 7.14 (a) : Variation of instantaneous thermal efficiency for the month of January of 'a' type weather condition of four different cities.

Figure 7.14 (b) : Variation of electrical efficiency for the month of January of 'a' type weather condition of four different cities

Figure 7.15 (a) : Monthly variation of overall thermal energy gain by considering a-d type weather condition for Jodhpur city

Figure 7.15 (b) : Monthly variation of overall exergy gain by
considering a-d type weather condition for Jodhpur city

Figure 7.16 (a) : Monthly variation of electrical energy gain by considering a-d type weather condition for New Delhi city

Figure 7.16 (b) : Monthly variation of thermal energy gain by considering a-d type weather condition for New Delhi city

Figure 7.17 (a) : Monthly variation of overall thermal energy gain by considering a-d type weather condition for New Delhi city

Figure 7.17 (b) : Monthly variation of overall exergy gain by considering a-d type weather condition for New Delhi city

Figure 7.18 : Variation of outlet air temperature with time for the month of December and May for 'c' type weather condition for New Delhi city

Figure 7.19 : Variation of useful heat gain with time for the month of May for 'a' type weather condition for New Delhi city

Figure 7.20 : Monthly variation of overall exergy efficiency by considering ‘c’ type weather condition for New Delhi city

Figure 7.21 : Variation of electrical efficiency & solar cell temperature for the month of May of 'a' type weather condition of New Delhi city

Figure 7.22 (a) : Variation of annualized uniform cost without considering the effect of EPBT at different expected life time
Figure 7.22 (b) : Variation of annualized uniform cost considering the effect of EPBT at different expected life time

Figure 7.23 : Hourly variation of solar intensity and ambient temperature in the month of May of 'a' type weather condition of New Delhi city

Figure 7.24 : Hourly Variation of Solar cell temperature and efficiency in the month of May of 'a' type weather condition of New Delhi city

Figure 7.25 : Hourly variation of outlet air temperature in the month of May of 'a' type weather condition of New Delhi city

Figure 7.26 : Hourly variation of Instantaneous efficiency $\frac{Vs}{(T_{airm} - T_a)} \frac{I(t)}{I(t)}$ in the month of May of 'a' type weather condition of New Delhi city

Figure 7.27 : Hourly variation of useful heat gain in the month of May of 'a' type weather condition of New Delhi city

Figure 7.28 (a) : Monthly variation of electrical energy gain for a, b, c & d type weather condition of New Delhi climatic condition

Figure 7.28 (b) : Monthly variation of thermal energy gain for a, b, c & d type weather condition of New Delhi climatic condition

Figure 7.28 (c) : Monthly variation of overall exergy gain for a, b, c & d type weather condition of New Delhi climatic condition

Figure 7.28 (d) : Monthly Variation of overall thermal energy gain for a, b,c & d type weather condition of New Delhi climatic condition
Figure 7.29: Annual thermal energy gain for four different cities of India by considering a-d type weather condition

Figure 7.30: Correlation diagram on the premise of yearly overall thermal energy gain by looking into a-d type climate condition

Figure 7.31: Correlation diagram on the premise of yearly overall exergy gain by looking into a-d type climate condition

Figure 7.32: Annual CO$_2$ emission reduction on the basis of overall thermal energy gain

Figure 7.33: Annual CO$_2$ emission reduction on the basis of overall exergy gain

Figure 7.34: Cost to reduce CO$_2$ emission annually (tCO$_2$e) on the basis of overall thermal energy gain

Figure 7.35: Cost to reduce CO$_2$ emission annually (tCO$_2$e) on the basis of overall exergy gain