Incidence angle relation

$$\cos\theta = \sin\phi(\sin\delta\cos\beta + \cos\delta\cos\gamma\cos\omega\sin\beta) + \cos\phi(\cos\delta\cos\omega\cos\beta - \sin\delta\cos\gamma\sin\beta) + \cos\delta\sin\gamma\sin\omega\sin\beta$$

IST LAT Conversion

Local apparent time = Standard time
± 4 (Standard time longitude – longitude of location)
+ (Equation of time correction)

Equation of Time Correction

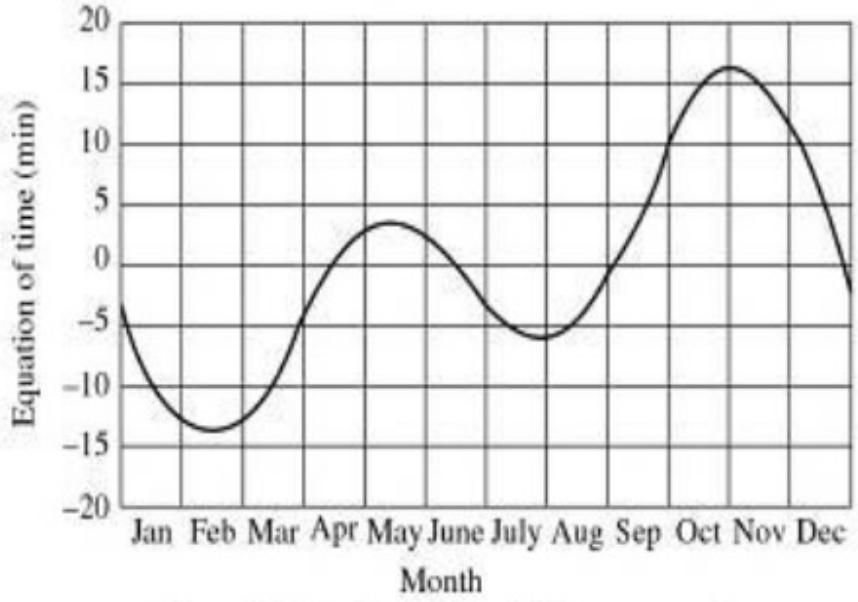

Fig. 3.14 *Equation of time correction*

$$E = 229.18\,(0.000075 + 0.001868\cos B - 0.032077\sin B - 0.014615\cos 2B - 0.04089\sin 2B) \quad (3.5.15)$$

where $B = (n - 1)\,360/365$ and n is the day of the year.

Correlation for monthly average daily global radiation

$$\frac{\overline{H}_g}{\overline{H}_o} = a + b\left(\frac{\overline{S}}{\overline{S}_{\max}}\right) \qquad (3.6.2)$$

Table 3.3 *Constants a and b in Eq. (3.6.2) for Indian cities**

Location	*a*	*b*	Mean error (per cent)
Ahmedabad	0.28	0.48	3.0
Bangalore	0.18	0.64	3.9
Bhavnagar	0.28	0.47	2.8
Kolkata	0.28	0.42	1.3
Goa	0.30	0.48	2.1
Jodhpur	0.33	0.46	2.0
Kodaikanal	0.32	0.55	2.9
Chennai	0.30	0.44	3.5
Mangalore	0.27	0.43	4.2
Minicoy	0.26	0.39	1.4
Nagpur	0.27	0.50	1.6
New Delhi	0.25	0.57	3.0
Pune	0.31	0.43	1.9
Shillong	0.22	0.57	3.0
Srinagar	0.35	0.40	4.7
Thiruvananthapuram	0.37	0.39	2.5
Vishakhapatnam	0.28	0.47	1.2

Correlation for monthly average daily diffuse radiation

$$\frac{\overline{H}_d}{\overline{H}_g} = 1.390 - 4.027\left[\frac{\overline{H}_g}{\overline{H}_o}\right] + 5.531\left[\frac{\overline{H}_g}{\overline{H}_o}\right]^2 - 3.108\left[\frac{\overline{H}_g}{\overline{H}_o}\right]^3$$

Hourly global, beam and diffuse radiation-ASHRAE model

Thus, $I_g = I_{bn} \cos \theta_z + I_d$

In the ASHRAE model, it is postulated that

$$I_{bn} = A \exp [-B/\cos \theta_z]$$

and $I_d = C I_{bn}$

Table 3.5 *Values of the constants A, B and C used for predicting hourly solar radiation on clear days*

	A (W/m^2)	B	C
January 21	1202	0.141	0.103
February 21	1187	0.142	0.104
March 21	1164	0.149	0.109
April 21	1130	0.164	0.120
May 21	1106	0.177	0.130
June 21	1092	0.185	0.137
July 21	1093	0.186	0.138
August 21	1107	0.182	0.134
September 21	1136	0.165	0.121
October 21	1136	0.152	0.111
November 21	1190	0.144	0.106
December 21	1204	0.141	0.103