

TUTORIAL SHEET 1

Exercise No. 1:

Consider the earth to be a blackbody with average surface temperature 15°C and area equal to $5.1 \times 10^{14} \text{m}^2$. Find the rate at which energy is radiated by the earth and the wavelength at which maximum power is radiated. Compare this peak wavelength with that for a 5800 K blackbody (the sun).

Exercise No. 2:

Calculate the earth's distance from the sun this days: 2nd of January, 3rd of January, 3rd of July and the 4rd of July.

Exercise No. 3:

Find the optimum tilt angle for a south-facing photovoltaic module in Tucson (latitude 32.1°) at solar noon on March 1.

Exercise No. 4:

Find the altitude angle and azimuth angle for the sun at 3:00 P.M. solar time in Boulder, Colorado (latitude 40°) on the summer solstice.

Exercise No. 5:

Find Eastern Daylight Time for solar noon for longitude 71.1°W on July 1st.

Exercise No. 6:

Find the time at which sunrise (geometric and conventional) will occur in for latitude 42.3° on July 1. Also find conventional sunset.

Exercise No. 7:

With your watch set for Pacific Standard Time (PST), you travel somewhere and when you arrive you note that the upper limb sunrise is at 1:11 A.M. (by your watch) and sunset is at 4:25 P.M. It is July 1st ($\delta = 23.1^{\circ}$, $E = -3.5 \text{ min}$). Where are you?

Exercise No. 8:

Find the direct beam solar radiation normal to the sun's rays at solar noon on a clear day for latitude 33.7° on May 21.

Exercise No. 8:

Find the direct beam solar radiation normal to the sun's rays at solar noon on a clear day in M'sila (latitude 35.71°) on March 22.

Exercise No. 9:

Find the beam insolation at solar noon on a collector that faces 20° toward the southeast if it is tipped (tilted) up at a 52° angle in M'sila (latitude 35.71°) on March 22.

Exercise No. 10:

Find the diffuse radiation at solar noon on a collector that faces 24° toward the southeast if it is tipped (tilted) up at a 48° angle in M'sila (latitude 35.71°) on June 22.

Exercise No. 11:

Find the reflected radiation at solar noon on a collector that faces 16° toward the southeast if it is tipped (tilted) up at a 39° angle in M'sila (latitude 35.71°) on September 22.