**Experiment No. (11)**

**(( Estimation of the amounts of solar radiation on )) horizontal surfaces**

**The purpose of the experiment:**

Calculation of the hourly values of direct, diffuse and total solar radiation on horizontal surfaces.

**Experience theory:**

**a.** The amount of direct solar radiation falling on a unit of horizontal surfaces can be calculated from the equation:



Wheras :

  Hourly value of direct solar radiation 

solar constant  

***t*** : air transparency 

m Optical path of radiation

  Sun elevation angle (degrees)

and to calculate The following equation is used:



T

**Whereas:**

 **Ф** : Latitude of the place in degrees.

$δ$**:** The angle of inclination of the sun in degrees.

$ω$ **:** The hour angle in degrees.

 for the days of the year. Table (1) shows the values of$ δ$

**b.** The diffuse solar radiation falling on horizontal surfaces can be calculated from the equation:



 Whereas 

,

It represented the absorption of solar radiation by water vapor, carbon dioxide, ozone and the rest of the atmospheric components.

C. The amount of total radiation falling on a unit of horizontal surfaces can be obtained from:



**Required:**

1- Calculate  From the equation:



T : The number of hours before or solar noon and the negative sign of the solar noon time.

2- Find value  From Table 1 for the desired day.

3- Calculate  for all values Calculate the value and then ***m***  From the equation:



4- Calculate the values of  of the two equations(1,3) then calculate From equation (4).

5- Arrange your calculations in a table as follows (Baghdad Latitude.

 ) 

6- Draw a graph between the values of solar radiation and the hours of the day and then discuss this graph.

