Lab No(3)

Calculate and estimate the value of the Function of Surface Roughness and Stability (p) using the power law of winds

Aims : Calculating and estimating the value of the atmospheric stability function and the surface roughness (p) using the exponential law. By directly recording the wind speed in the wind tunnel.

Tools:

1- Wind Tunnel

2- Heterogeneous obstacles

3- Anemometer

4- stopwatch

Theoretical Part:

The exponential law of wind has been used extensively in the study of both fluid mechanics as well as in wind engineering, because it can represent wind patterns to depths beyond the surface layer. The exponential law of wind is given by the following formula:

$$\frac{u_2}{u_1} = \left(\frac{z_2}{z_1}\right)^p \qquad \ldots\ldots\ldots (1)$$

By taking the logarithm of equation (1), we get:

$$log\frac{u_2}{u_1} = \log\left(\frac{z_2}{z_1}\right).p \qquad \ldots\ldots\ldots (2)$$

$$\mathrm{p} = \frac{\log\left(\frac{u_2}{u_1}\right)}{\log\left(\frac{z_2}{z_1}\right)} \qquad \ldots\ldots\ldots (3)$$

Methodology:

1 - Turn on the wind tunnel device.

2 Record the wind speed by wind speed measuring device for different heights, with a record of every (2.5 cm).

3 - Calculate the value of the function p from equation No. (3) for each two levels of height.

4 - Calculate the mean value of the function (p).

5 - Through Equation No. (1), calculate the wind speed for all recorded heights, depending on the value of the (p-rate).

6 - Graph the vertical change of wind speed (calculated and recorded) and compare them (wind speed on the x-axis and height on the y-axis.

Height z(m)	Measured wind speed U (m/sec)	p. value	Calculated wind speed U (m/sec)