E.T.S. Ingenieros de Caminos, Canales y Puertos
Universidad de Granada

EJERCICIO 3 – ENTREGA 14 SEPTIEMBRE 2009

NOTA: Los enunciados se presentan en Inglés. Se valorará la respuesta en el mismo idioma con hasta un 20% de la nota adquirida.

1. Measurements of the mean wind speed ($\overline{U}$) at two heights (Z-d) in the atmospheric boundary layer give the following values:

Z – d (m)	$\overline{U}$ (m/s)
10	16.61
50	27.20

where d is the zero plane displacement.

Assuming that these data fit both a logarithmic law profile and a power law profile calculate;

(i) the power law exponent (α)
(ii) the roughness length (z_o)
(iii) the shear velocity (u_*) normalised by the mean wind speed at Z-d = 10 m.

[5]

2. Briefly state the advantages and disadvantages of both the logarithmic law and power law representations of the atmospheric boundary layer wind speed profile.

[1]

3. From the data you have obtained in (a), over what type of terrain was this wind profile measured? Briefly explain the reasons for your answer.

[1]

4. The velocity profile of the boundary layer approaching a tall building has a shape that may be represented by a power law expression with an exponent of 0.28. The building has a square planform and is 75 m high. Much of the external wall area is taken up by glass panels of dimensions 1.5 m x 2 m. The centre of the highest panel is 65 m from the ground and the peak pressure coefficient for the external wind loading is –3.5, based on the dynamic pressure of the wind at that height. The internal pressure coefficient inside the building, defined in the same way, is +0.2. The strength of the window frame sealing against pull-out failure is 4.5 kN per metre run of the perimeter. During a storm the wind speed measured at a height of 10 m above the ground is 28 m/s.

Using the above information estimate the factor of safety (= resistance / applied load) for pull-out failure of the glazing panel due to this storm wind loading. Take the density of air to be 1.24 kg/m^3.

[3]