Final exam questions

Subject group name: **Fluid Mechanics elective – Building and Environmental Aerodynamics**

Neptun code: ZVEGEÁTNW08

Credit points: 3

Subject in this subject group:

- **Building and Environmental Aerodynamics** (BMEGEÁTNW08)

Program: Mechanical Engineering Modelling, MSc (2N-MW0)

Specialization: Fluid Mechanics

Responsible person:

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You can check the current subject forms at the Educational Portal of the Faculty of Mechanical Engineering.

https://oktatas.gpk.bme.hu/

Always check the for updates at edu.gpk.bme.hu before preparing for the exam, especially if the subject group contains at least one subject from your final semester!

Valid from 01 September 2021

Dr. Márton Balczó

assistant professor

1. Characteristics of the atmospheric boundary layer. Sublayers, and the explanation for various sublayers. Forces in the Ekman layer. The logarithmic and power-law approach of boundary layer wind profile. Roughness length, displacement height. Surface categories. Wind velocity distribution over hilltops/escarpments.
2. The gustiness of wind, vertical profile of average and peak wind speed in the ABL. Define gust factor and peak factor. The typical values for gust factor and peak factor. Relation between gust factor and averaging time (draw schematic diagram) Vertical profile of turbulence intensities in the boundary layer. The role of turbulence intensity on wind loading of a simple cubic building.
3. Definition of lapse rate. Explain under which conditions is considered the atmosphere (or a part of it) as stable. Explain latent heat release and the saturated adiabatic lapse rate. Give the approximate values of dry and saturated adiabatic lapse rates (approximately). Describe the development of convective storms. Gravity waves behind mountain ridges.
4. Bluff body aerodynamics: comparison of flow around bluff and streamlined bodies in a real (viscid) fluid. Expression of wind force acting on a solid body by friction and pressure coefficient. Order of magnitude of friction and pressure coefficients. (max. and min. values)
5. Boundary layers: laminar and turbulent. Boundary layer separation, conditions, examples, control. Consequences of flow separation on pressure distribution over building surfaces. Magnitude of pressure and velocity inside separation bubbles.
6. Flow around a simple rectangular block building (sharp-edged cube): flow structures, surface regions, approximate pressure coefficient values, and other flow features (shear layers, vortices, separation bubbles etc.) Regions with peak wind loading on the roof. Flow field and pressure distribution at 45° angle flow around the cube.