Possible questions from topic of **turbulence an it modeling** in CFD (BMEGEÁTMW02)

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- ✗ List the properties of turbulence!
- ✗ Describe what does it mean:
  - High Re number
  - disordered chaotic
  - 3D phenomena
  - Unsteady
  - Continuum phenomena
  - Dissipative
  - Vortical
  - Diffusive
  - Continues spatial spectrum
  - Has history
- ✗ What is the reason to use ensemble averaging to describe turbulence? Give examples where temporal averaging fails!
- ✗ Define the statistical characteristics of turbulent flows, Reynolds decomposition!
- ✗ Describe the properties of the Reynolds averaging operator!
- ✗ Define covariance, correlation, auto correlation!
- ✗ Define the integral timescale of turbulence! Introduce the Taylor hypothesis to approximate length scales of the flow!
- ✗ Describe the development and the Reynolds equations!
- ✗ Define the kinetic energy in turbulent flows (Reynolds decomposition)!
- ✗ Describe the hypothesis of Richardson about the energy cascade!
- ✗ How are the big and small scles connected trough the Richardson energy cascade?
- ✗ Write the transport equation of k!
- ✗ Explain the meaning of:
  - Production
  - Transport
  - Dissipation
- ✗ Describe the eddy viscosity modeling approach! What is the concept behind it?
- ✗ Why is k and epsilon appropriate to approximate the turbulent viscosity? What is equation?
- ✗ Describe the standard modeled k equation!
- ✗ Introduce the concept of developing the standard epsilon equation and its final form!
- ✗ What is behavior of the standard k-epsilon model for decaying turbulence?
- ✗ What is the k-omega model compared to the k-epsilon?
- ✗ Describe the inlet boundary conditions for two equation RANS modeling!
- ✗ Introduce the turbulent channel flow problem, and introduce the two different length scales!
- ✗ Describe the law of the wall in the viscous and the logarithmic range!
- ✗ Summaries important characteristics of turbulence in wall boundary layers!
- ✗ Introduce the two different wall boundary condition approaches in RANS!
- ✗ What is the difference between modelling and simulating turbulence?
- ✗ What is DNS?
- ✗ Introduce the concept of LES and the usual filtering approach!
- ✗ Show some filtering kernels, and their effect in physical and spectral space!
- ✗ Show the energy spectrum in LES!
- ✗ Write the filtered equations and the term to be modeled and its name!
- ✗ Describe the eddy viscosity models for LES and the Smagorinsky model!
- ✗ Describe boundary conditions for LES!