



## Final exam questions

Subject group name: **Measurement in Energy Engineering**

Neptun code: ZVEGEENNWME

Credit points: 3

Subject in this subject group:

- **Measurement in Energy Engineering (BMEGEENNWME)**

Program: Mechanical Engineering Modelling MSc (2NAMW0-2019)

Specialization: Thermal engineering

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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](http://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. Edit CSÉFALVAY  
associate professor

## I. Temperature measurement

1. What is the basic principle of thermocouple and RTD?
  - a) Which of them has self-heating problems and why?
  - b) Illustrate your explanation with figures!
2. If we have a Type J thermocouple why can't we measure the Seebeck voltage directly with a Copper voltmeter? What shall we do to avoid the problem? Illustrate your explanation with figures!
3. Why do we use Wheatstone bridge at RTDs. What kind of problem is avoidable with the use of this bridge? Illustrate your explanation with figures!

## II. Emission measurement - pollutant formation

1. What is air excess ratio?
2. What is adiabatic flame temperature, how does it depend on air excess ratio?
3. Which harmful components do form during combustion, why are they harmful? How can they be measured (explain operation principle)?
4. Describe NO formation processes! Describe the primary NO decreasing methods! Explain operation principle measurement method!
5. Describe the formation of components of incomplete combustion! How can their amounts decreased in flue gas?
6. Which are the harmful components of exhaust gas? Why are they harmful? How do the concentrations of emission components depend on air excess ratio?

## III. Emission measurement – solid components

1. Describe cross-stack measuring technique! (advantages, disadvantages) Describe extractive measuring technique! (advantages, disadvantages). What are the requirements of analyzers?
2. Describe NDIR! (operation principle, detected components), Describe CLD! (operation principle, detected components), Describe FID! (operation principle, detected components), Describe PMD! (operation principle, detected components)
3. How can we measure the dust emissions?
4. How can we measure the smoke emissions? Explain measurement system of the particulate matters Describe Gravimetric measurement (operation principle, detected components). Describe Condensation Particle Counter (operation principle, detected components)

## IV. Biomass combustion

1. List and describe the solid fuel combustion steps! Draw a scheme and give the temperature ranges!
2. Compare solid and liquid fuel analysis via these methods:
  - a) Describe thermogravimetric analysis, equipment, and method!
  - b) Describe the GC-MS analysis, equipment, and method!
3. List liquid fuel combustion properties and describe them (point of solidification, flash point, firing point, Conradson number)