# EEN-E2002 Combustion Technology / 2019

# Extra task

The exercise is for those students who got fewer than 18 points from LE 5. The exercise is meant to be completed individually. The solution is to be returned as a single pdf file into the "Extra task" submission box at the MyCourses site of the course.

The solution must be clear and readable, and it may be hand-written or created with a computer. The equations and input data that you are using must be clearly specified, as well as any sources you have used. Include tables and diagrams to illustrate your results as requested in the problem. Please note that all students are expected to follow the Aalto University Code of Academic Integrity (see https://into.aalto.fi/display/ensaannot/Aalto+University+Code+of+Academic+Integrity+and+Handling+Violations+Thereof ).

Name the uploaded pdf-file so that it tells the name of the course, learning exercise number, and your name, like Combustion_Technology_Extra_Lastname.pdf.

The maximum number of points that can be obtained from this task is 12. It is not required that the whole task is completed; it is sufficient to work just to obtain the missing number of points. For instance, for a student who got 10 points from LE 5, a minimum of 8 points is required for this task, etc.

Return deadline of LE5: Monday, 6th May, 2019 at 16:00 pm.

Please read the problem statement carefully! Note that there are two pages.

## Task 1 (3 x 4 p. = 12 p.)

We will continue analyzing the situation outlined in LE 4 and LE 5. You may want to have a copy of the problem statements and model solutions of LE 4 and LE 5 at hand when you start working.

In all following calculations, it is assumed that ethanol is used as a fuel and the firing rate is 3.5 MW (based on LHV). It is also assumed that both fuel and combustion air enter the furnace at 25 °C. The oxygen mole fraction in dry flue gas is assumed to be 2.0 %.

a) The exit temperature of the flue gas is 127 °C. Calculate the flue gas loss (kW) and estimate furnace efficiency (%) for air factor range from 1.0 to 1.4. You do not need to produce analytical expressions for flue gas loss and furnace efficiency; it is sufficient to produce a table containing a suitable set of values for the air factor. Present a plot of your results. Your calculations should be

based on LHV of the fuel. In estimating the furnace efficiency, you only need to include the flue gas loss in the efficiency calculation.

b) As item a), but assume that the flue gas exit temperature is 177 °C.
c) As item a), but assume that the flue gas exit temperature is 227 °C.

Attach a list of your sources (a reference list) in your solution. When you present your findings, specify the sources using the normal conventions of scientific writing (see, e.g., http://libguides.aalto.fi/citation_guide . Please include also the page number containing the information.