**EPSH1/PED1/WPS1**

**2012**

**May 2012/CLB/SMN**

**Written EXTRAORDINARY re-examination in**

**High Voltage Engineering and Design of Switch Mode Converters**

**xxxday Xth yyyy 2011**

**09.00 – 13.00 (4 hours)**

Please provide sufficient text description and reference to textbook and equations so your method of solution is clear and easy to follow. Statements and results will only give credit if explained thoroughly.

Both exercises in HV and SMC individually have to be passed in order to pass the course. This means that at least 50 % of both the HV exercise and the SMC exercise have to be correctly answered.

The HV exercise and the SMC exercise have the same weight.

***A laptop with MATLAB or similar should be used for solving the HV exercise 1. Results (graphics and MATLAB file) from this should be printed and handed in together with written parts of solution and the complete exam exercise set.***

**Exercise 1 (33 % High Voltage)**

A resistive voltage divider should be modeled with the purpose of calculating its unit step response and response time. The resistance is R = 50 kΩ. The following conditions must be used for solving the exercise:

* Resistive voltage divider must be modeled using a distributed parameter model
* Resistive voltage divider can be assumed cylindrical having a diameter d = 10 cm and a height l = 2,4 m
* Series inductance L and parallel capacitance Cp can be neglected

a) Draw a precise graph showing the unit step response g(t) of the resistive voltage divider.

b) Calculate the response time T0 for the resistive voltage divider without approximations by using the definition given in Kuffel eq. (3.50)

c) Comment on the differences between using a distributed parameter model and the first order model with a truly exponential rise.

**Exercise 2 (17 % High Voltage)**

Students attending the HV course at AAU/ET have been performing measurements of partial discharges in the HV laboratory. They used the standard “straight detection” method and got the result shown in the graph below.



a) Explain precisely the quantities shown by the three axes of the graph.

b) Identify and categorize the type of partial discharges shown in the graph. Which type of setup (test specimen) will create this particular type of discharges? Draw a simple sketch of the test specimen and explain why this produces partial discharges as shown in the graph.