S-17.2030, Electromechanics and Electric Drives,
Final examination 8.5.2008, 9-12, S4.

You have 3 hours to answer the 5 questions. <u>Please answer questions 1 and 2 on a separate sheet of paper.</u> You may leave after 1 hour from the beginning of the exam. Write your name on <u>each</u> answer paper.

Good Luck!

<u>**Theory**</u>

1)   (15 p) Define and explain briefly (use drawings when adequate).

   a) Explain the role of the compensating winding in a DC machine.

   b) Explain the role of the collector in a DC machine.

   c) Explain the advantages of the direct torque control for an induction machine.

   d) What is the slip of a 4-pole induction machine, with a stator current frequency of 60Hz. You know that the rotor is rotating at a speed of 1790 rpm. Help yourself by defining first the slip.

   e) Explain the construction of a three phase transformer unit.

2)   (11p) We consider a synchronous machine in the following question.

   b) The armature quantities of a synchronous salient pole machine can be resolved into two components, one acting along the d-axis and the other one acting along the q-axis. Explain what those reactances mean physically.

   c) How can we obtain the steady-state(X_d), transient($X_d^{'}$) and sub-transient($X_d^{''}$) reactances for a 2-pole-pair salient pole synchronous machine?

   > i) What is a transient state and why do we study it?
   > ii) Explain properly the different steps that you could follow to make your measurements, and justify them. *Hint: How you would connect the machine? And why?*
   > iii) In addition, draw approximately the behavior of the current during the measurements as function of the time.
   > iv) Locate the steady state, transient and sub-transient periods on the graph.