

T-106.5300 Embedded systems

The exam contains five questions. The maximum points for each question are listed in the beginning of the questions. Read the questions carefully. Give clear and compact answers. Remember to write the name of the course and your own personal information on each of your answer papers. No extra appliances are allowed in the exam.

- 1 (6p) Consider a rotating robot where you can control the angular velocity around a fixed axis. Model this as a system where the input is angular velocity $\dot{\Theta}$ and the output is angle Θ . Give your model as an equation relating the input and output as functions of time. Is your model BIBO stable?
- 2 (6p) Consider a single processor real-time system with three tasks, whose periods are 6ms, 5ms, and 10ms. The required processor times for the tasks are 1.5ms, 1ms, and 0.3ms, respectively. Can the system be schedulable if static priorities are used? Give a proof and explain your proof.
- 3 (6p) Explain what a PID controller is and how it operates. How a PID controller is designed and how it is used?
- 4 (6p) Consider an indoor race track for 1:10 scale RC cars that have RFID tags attached. There are RFID tag readers available with USB connectivity. Your task is to design the embedded HW and SW solution for the race result table, which is a large multirow alphanumeric display controlled by commands over a serial line. Sketch and explain your design. Justify your design choices.
- 5 (6p) Considering fault tolerance in embedded systems, write an essay that is not longer than 45 lines.