

ANALOG IC DESIGN  
Examination 5.3.2018

1. Explain

- (a) Opamp slew rate (1p).
- (b) White noise (1p).
- (c) Thermal noise (1p).
- (d) Idea of  $G_mC$ -filter (3p).

2. Draw in schematic/transistor level the two-stage operational amplifier with PMOS input transistors. Include compensation capacitor (4p).
3. Explain the following phenomena related to the Sample & Hold operation:
- a. Hold step (2p).
  - b. Droop rate (2p).
  - c. Aperture jitter (2p).
4. Below, there is a schematic of a non-inverting and inverting SC-integrator.
- a. Which one of the two types is the integrator on the top (1p)?
  - b. Which integrator has a one clock delay from input to the output (top or bottom) (1p)?
  - c. Which one of the integrators has a transfer function of form  $(C_1/C_2)(z^{-1})/(1-z^{-1})$  (top or bottom)(1p)?
  - d. Why is it important to have capacitance ratios in transfer functions instead of single absolute values when designing IC (1p)?

