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Exam – 14.3.2013

You may not use any notes, but **use of your own calculator is allowed**.
Each question is worth six (6) points.

1. Explain BRIEFLY the following terms or perform the tasks:
   - Cascade connection of amplifiers.
   - Inverting and non-inverting amplifier.
   - Ideal voltage amplifier model.
   - Draw the circuit symbol of npn BJT and mark the directions of the currents and the polarities of the voltages, when BJT is in active region.
   - In which region of operation the NMOS transistor can be used as a controllable resistor?
   - Power added efficiency (PAE) in power amplifiers.

2. Draw the circuit schematic and explain the operation of Common Collector amplifier.

3. (a) In Figure 1 is shown a basic Common Gate LNA. How it should be modified to obtain LNA with gain step? Draw the schematic and explain how the gain step is achieved. (b) Which LNA configuration, Common Base or Common Emitter, couples more signal (backward) to the antenna?
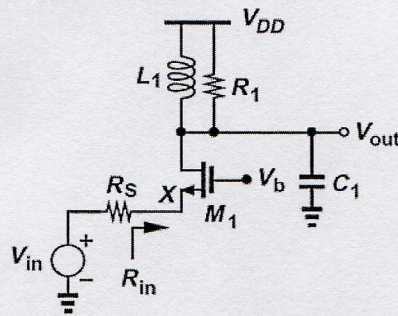

Figure 1. Basic CG LNA.

4. Draw a **block** diagram of a simple phase locked loop (with low pass filter) and explain its operation. Support your explanation with waveforms.

5. (a) Which type of power amplifier is shown in the Figure 2? Explain the operation principle of this power amplifier. What is the ideal maximum drain efficiency this PA could achieve? (b) Compare the PA in Figure 2 with at least two other PAs in terms of efficiency. Explain briefly why the efficiency is higher or lower in other PAs?
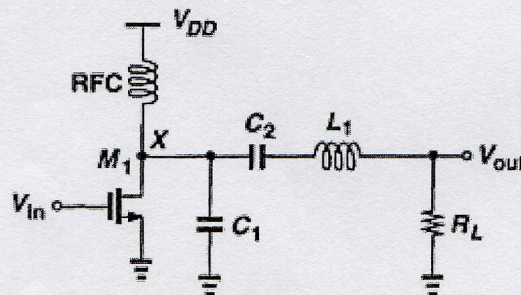

Figure 2. Some power amplifier.