**ECE5220 RFIC Midterm, 03/19/2012 Name: Grade:**

1. In the amplifier shown below, DC characteristic of the NMOS is set by square-law characteristic, i.e.

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Assume that Rs << 1/Cgs, **all resistors are noisy** and NMOS has drain thermal noise current. The drain thermal noise coefficient is .



1. Determine feedback resistance, RF, to match input and output impedance to Rs and RL, respectively (5pt).

2) Express output noise voltages due to Rs, RF, Rb, RL and drain current (IDS), respectively, under matched condition (20pt). **You don’t need to calculate them numerically**.

3) Calculate noise factor (F) under the impedance matched condition (10pt).

4) Calculate THD without feedback (RF=∞). Assume that Vs=40 mVp (10pt).

5) With RF, determine feedback factor and loop gain (10pt).

6) Calculate THD with feedback. Also assume that Vs=40 mVp (10pt).

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1. Consider the cascaded system shown below. All interfaces are matched to 50  and signal bandwidth is 1MHz. **The required output SNR is 20 dB**.



1. Determine input noise floor and input minimum detectable signal (MDS) of the system in dBm scale (10pt). Note, 10\*log(KT)=-174 dBm @T=300K.
2. Determine spurious free dynamic range (SFDR) of the system (10pt).

3) What is the maximum input power that allows no spurious tone? (10pt).