Simulation Question

5. Consider the following amplifier circuit, using the ADS in 180 nm technology, answer the following questions. **(35)**

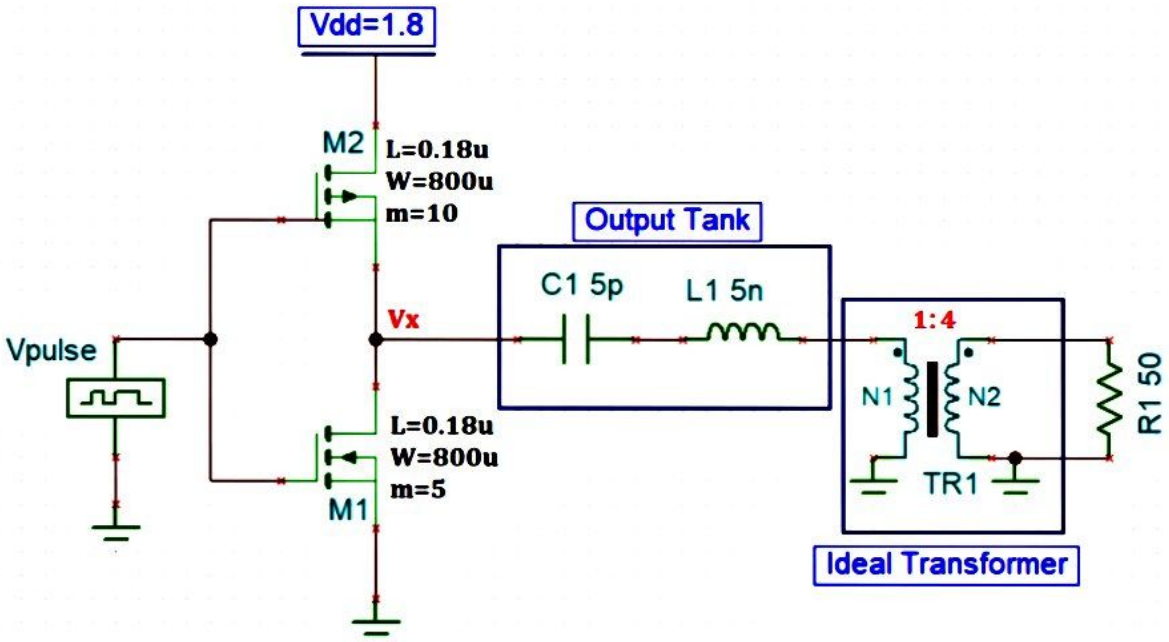

Fig. 7 A specific amplifier circuit

a) Calculate the output power and consumed power in the circuit using simulation **(5)** (SIMULATION)
b) Plot Ids1, Ids2 and the load current wave forms **(6)** (SIMULATION)
c) Calculating the Fourier series of IDEAL waveform of simulated Ids1, explain in detail what harmonics this signal has? **(9)** (ANALYTICAL-CONCEPTUAL)
d) Plot Vx voltage waveform. Explain in detail why this waveform looks like this? **(5)** (SIMULATION)
e) Calculating the Fourier series of IDEAL waveform of simulated Vx, explain in detail what harmonics this signal has? **(5)** (ANALYTICAL-CONCEPTUAL)
f) What is the role of output tank circuit? What is the relationship between the power losses in the circuit and the output tank? If there is no output tank circuit, what happens from the harmonic point of view and the power in the circuit? **(5)** (CONCEPTUAL)

1. With Q=10, the matching circuit below is used to convert RL=200ohm to Rin=50ohm @ f0=5.6GHz. Use **ADS** and design the required RLC components. (Use Smith Chart Tool in ADS)

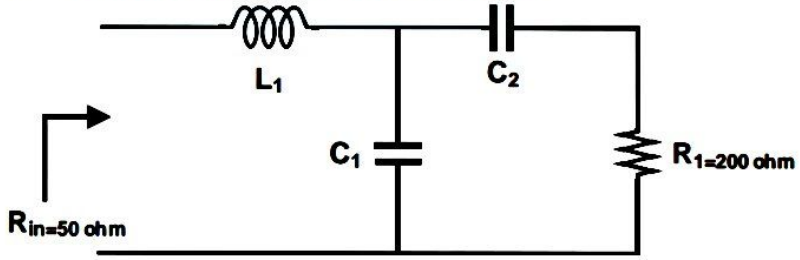

Fig.1 matching circuit

2. Consider the following LNA:
   a) Plot the Gain curve in 1-3 GHz frequency range. At which frequency the gain is maximum?
   b) Plot the NF curve in 1-3 GHz frequency range. At which frequency the NF is minimum?
   c) Calculate the power consumption by simulation and describe the calculation procedure. (Assume an appropriate bias voltage so that all the transistors will be ON and the total power consumption be less than 12 mW). Perform your simulation using the Cadence Spectre in 180 nm technology.

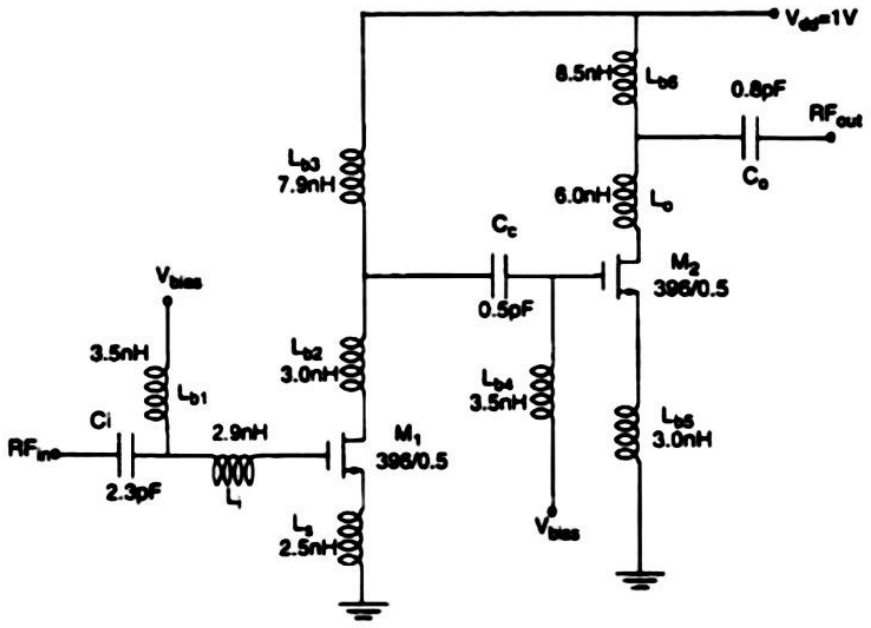

Fig. 2 LNA circuit

5. With Q=10, the matching circuit below is used to convert RL 200ohm to Rin=50ohm @ f0=2.4GHz. Use **ADS** and design the required RLC components. (Use Smith Chart Tool in ADS)

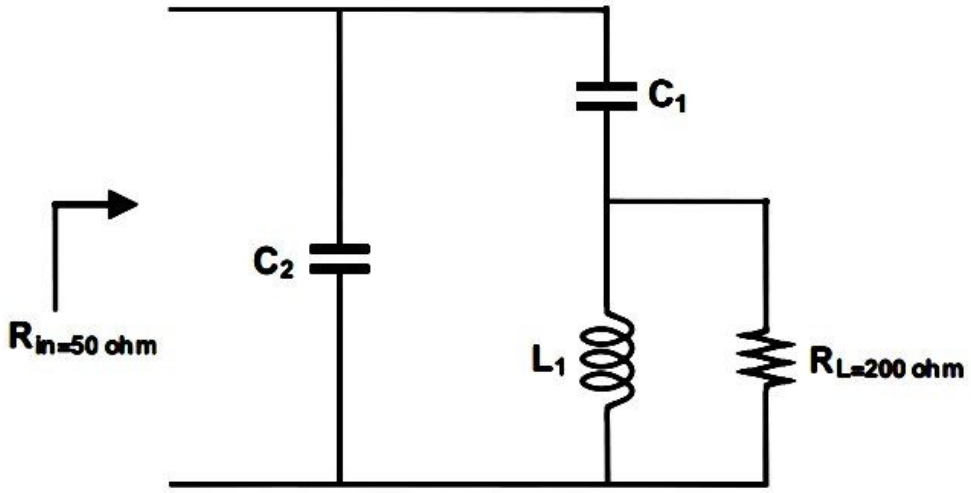

Fig.5 matching circuit