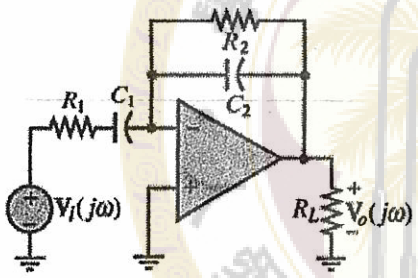
國立臺灣大學101學年度碩士班招生考試試題

1. Please draw the electron concentration versus temperature (temperature from 0K to 1000K) for an n-type semiconduction doped at $1X10^{14}$ cm^{-3}.
   a) Please indicate the three regions in the plot. (6%)
   b) Please draw the energy diagram of each region. (6%)
   c) Please use a) and b) to explain the curve trend of each region. (6%)

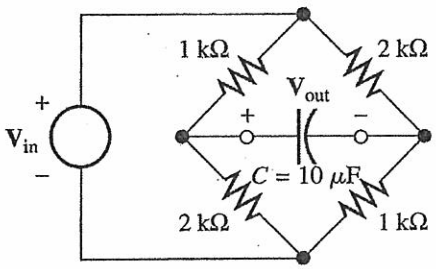
2. The reverse saturation current densities in a pn junction diode and a Shottky diode ar $5X10^{-12}$ A/cm^2 and $7X10^{-8}$ A/cm^2, respectively, at T=300K. The cross-sectional area of the pn junction diode is A= $8X10^{-4}$ cm^2. Determine the cross-sectional area of the Shottky diode so that the difference in forward-bias voltages to achieve 1.2 mA is 0.265V. (7%)

3. Analyze the basic OP Amp circuit in the following figure: C_2=C_1=0.1μF, R_1=R_2=10K Ω.
   a) The gain or transfer function of this filter. (5%)
   b) The resonant frequency of this filter. (5%)
   c) The cutoff frequency (frequencies) of this filter. (5%)
   d) The circuit Q. (5%)
   e) Sketch the Bode Plot. Is this circuit a low-pass, band-pass or high-pass filter? (5%)



4. A multipole amplifier having the first pole at 8 MHz and a dc open-loop gain of 60 dB is to be compensated for closed-loop gains as low as unity by the introduction of a new dominant pole. At what frequency must the new pole be placed? (15%)

5. Find the transfer function of the following circuit and determine the value of the half-power frequency. (15%)



6. (a) For the following folded-cascode CMOS op amp, please indicate clearly the plus (+) and minus (-) signs for the inputs (V_{in1} and V_{in2}) and explain why the input polarity is correct for your assignment. (10%)
   (b) Please find the output resistance of the op amp. (10%)

見背面

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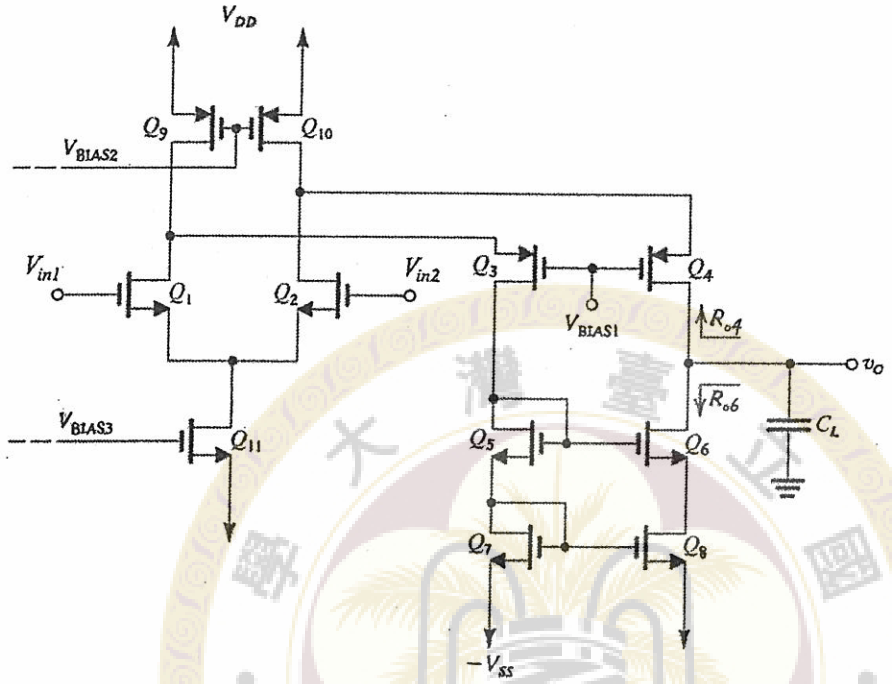

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