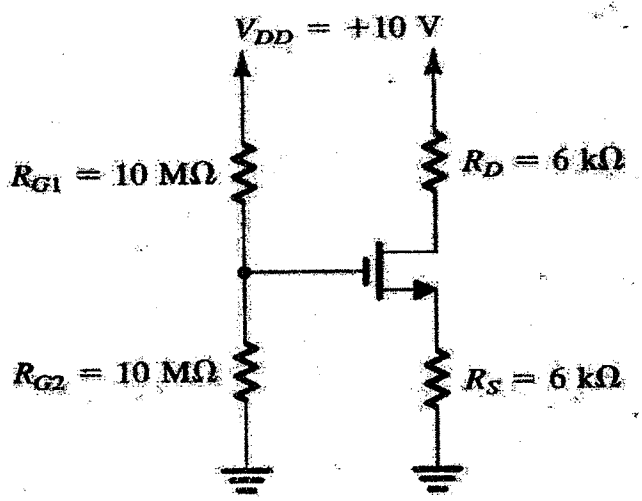
系所組：機械工程學系數位機電碩士班丙組

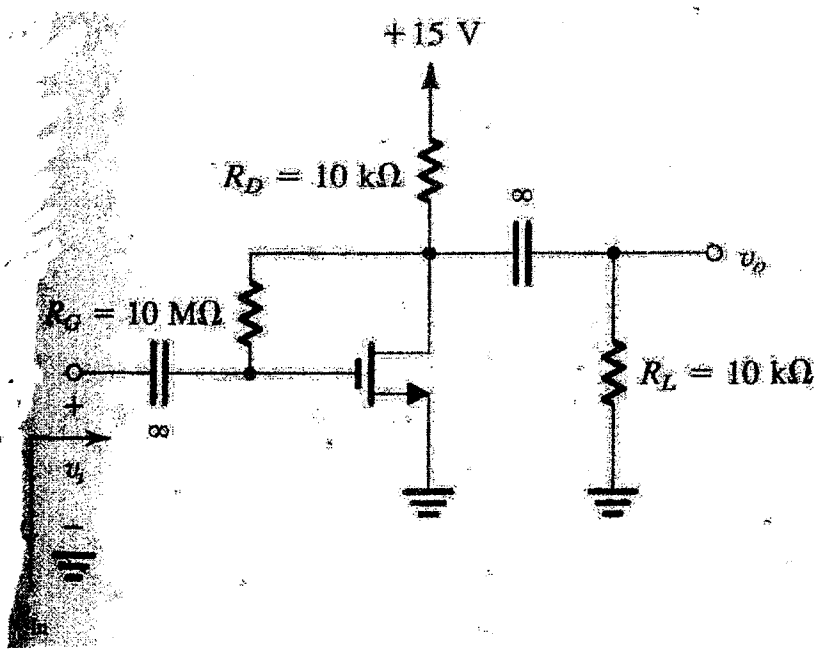
日期節次：100 年 3 月 20 日第 2 節 11：00-12：30

科目：電子學

1. Analyze the circuit shown in the following figure to determine the voltages at all nodes and the currents through all branches. Let $V_t = 1$ V, $k_n'(W/L) = 0.25$ mA/V^2. Neglect the channel-length modulation effect (i.e. assume $\lambda = 0$). [20]



2. The following figure shows a discrete common-source MOSFET amplifier utilizing the drain-to-gate feedback biasing arrangement. The input signal v_i is coupled to the gate via a large capacitor, and the output signal at the drain is coupled to the load resistance R_L via another large capacitor. We wish to analyze this amplifier circuit to determine its small-signal voltage gain, its input resistance, and the largest allowable input signal. The transistor has $V_t = 1.5$ V, $k_n'(W/L) = 0.25$ mA/V^2, and $V_A = 50$V. Assume the coupling capacitor to be sufficiently large so as to act as short circuits at the signal frequencies of interest. [20]



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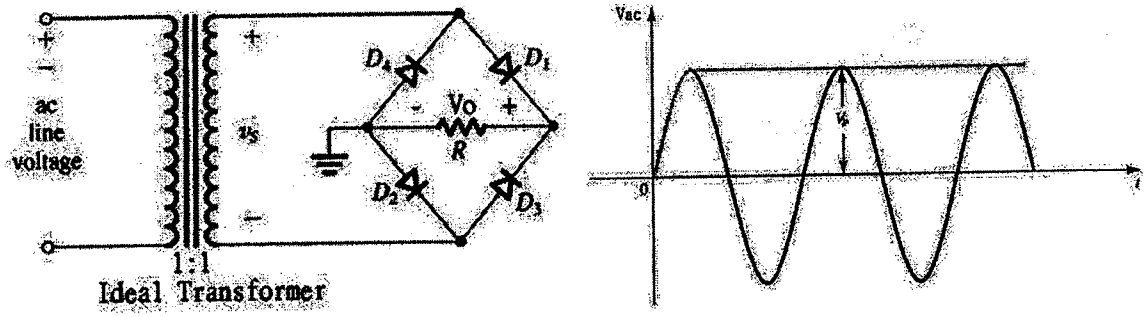
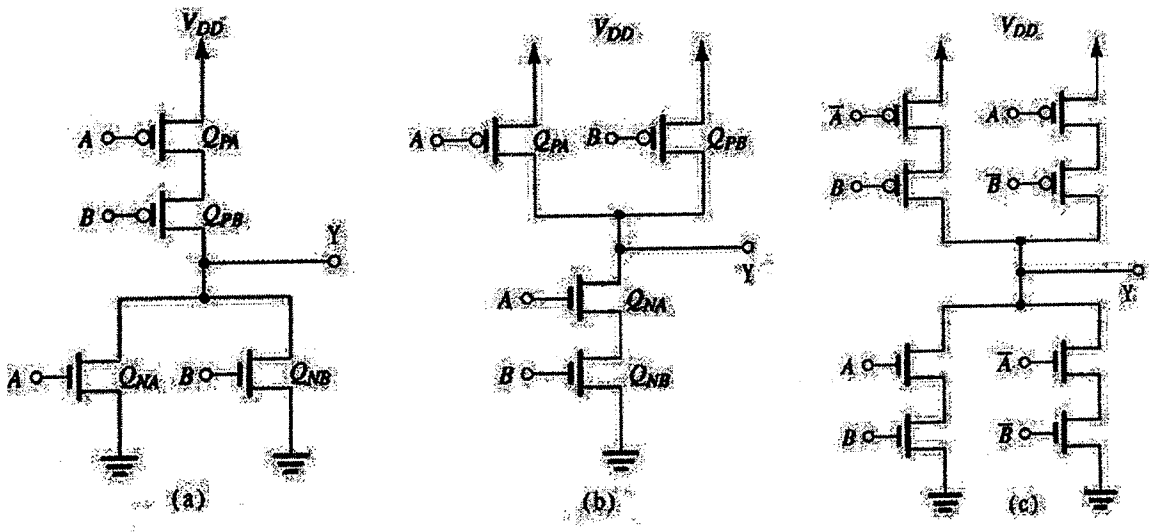
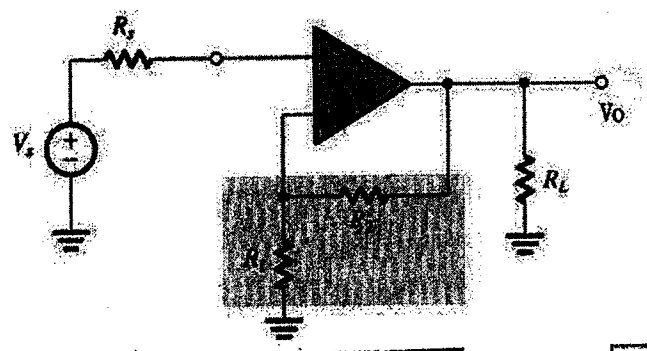
3. Give a Bridge Rectifier, shown at the left part of the following figure. A sinusoidal input voltage source, v_{ac}, is an AC voltage source with its peak equal to V_p. The waveform of v_{ac} is drawn at the right part of the given figure. It has assumed that all diodes are ideal diodes. Please plot the waveform of output voltage, V_o, with respect to input voltage source. [15]



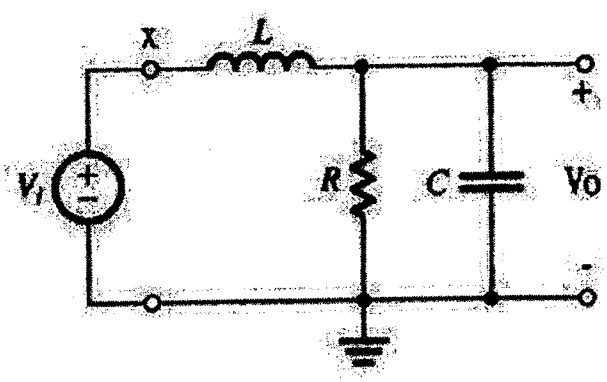
4. Give three CMOS circuits, shown as follows. Please write down the digital operations of output Y. [15]



5. A non-negative OP-AMP circuit with an implementation of a feedback loop is shown on the following figure. It has assumed that the OP-AMP has infinite input and zero output resistance. Please answer these questions: (a) Find out the expression of the feedback factor, β. (b) If the open-loop voltage gain of this OP-AMP is 10^4 ($A=10^4$), find out R_2/R_1 to obtain a closed-loop voltage gain A_f of 10. [15]



6. Give a RLC circuit, shown as follow figure. [15]
   (a) Please derive the transfer function, T(s), where s=jw.
   (b) Please determine what type filter operation it is.
   (c) Give a brief explanation of the previous question and find out the natural frequency (w_0) and quality factor (Q).



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