

國立台灣科技大學九十八學年度碩士班招生試題

系所組別： 電子工程系碩士班乙二組、乙三組

科 目： 電子學

(總分爲 100 分)

- For the circuit in Figure P1, let  $\beta = 125$ ,  $V_{BE(on)} = 0.7V$ , and  $V_A = 100V$ . (a) Determine the quiescent collector current  $I_{CQ}$ . (b) Determine the small-signal voltage gain. (c) Determine the input resistance seen by the signal source. (d) Determine the output resistance looking back into the output terminal. (20%)

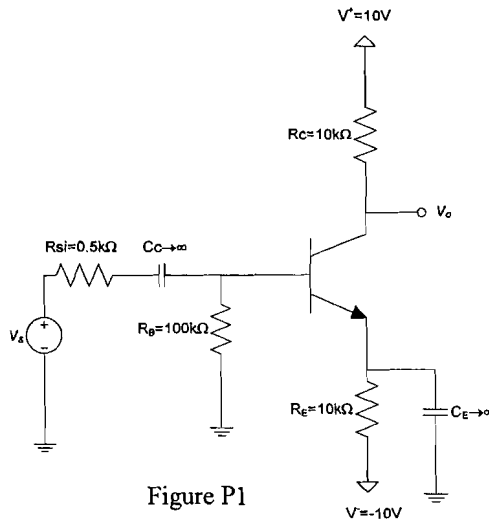


Figure P1

- For the PMOS common-source circuit shown in Figure P2, the transistor parameters are :  $V_{TP} = -2V$ ,  $K_p = 1mA/V^2$ ,  $\lambda = 0$ ,  $C_{gs} = 15pF$ , and  $C_{gd} = 2pF$ . (a) Determine the quiescent current  $I_{DQ}$ . (b) Find the midband voltage gain. (c) Determine the upper 3dB frequency. (d) What is the equivalent Miller capacitance? (20%)

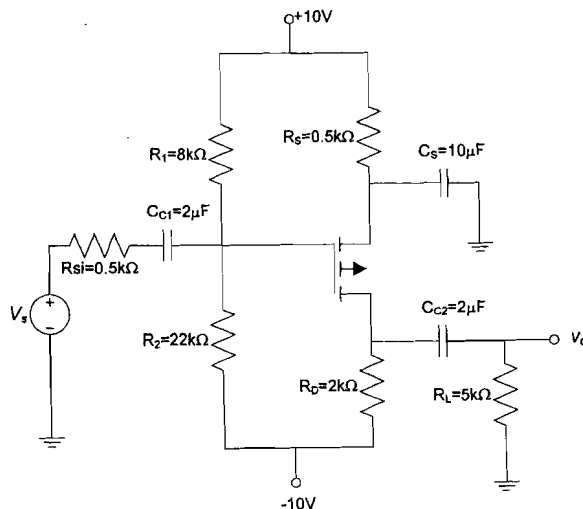
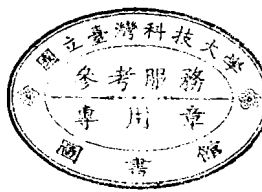


Figure P2



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(總分為 100 分)

3. Sketch the steady-state output voltage  $v_o$  versus time for each circuit with the input voltage  $v_i$  shown in Figure P3. Assume that the turn-on voltage  $V_f = 0$  and assume the RC time constant is large. (10%)

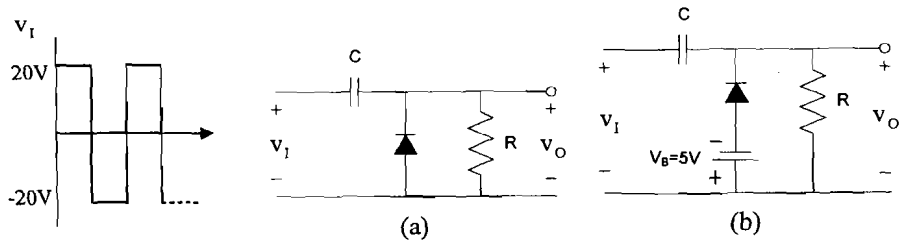


Figure P3



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4. Consider the oscillator circuit in Figure P4. (a) Derive the expression for the loop gain  $T(s)$ . (b) Determine the expression for the frequency of oscillation. (c) Find the condition for oscillation. (15%)

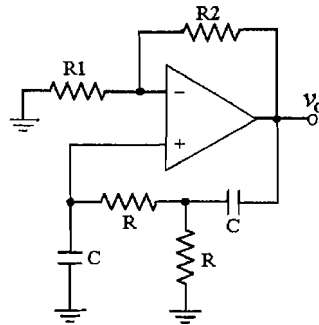


Figure P4

5. For the voltage amplifier in Figure P5, assume that  $R_1=20k\Omega$ ,  $R_2=2k\Omega$ . The op-amp parameters are  $A_v=10^4$ ,  $R_i=50k\Omega$ , and  $R_o=1k\Omega$ . The transistor parameters are  $h_{FE}=100$ ,  $V_A=\infty$ , and it is biased at  $I_{CQ}=0.1mA$ . Determine the closed-loop voltage gain  $A_{vf}=v_o/v_i$ . (20%)

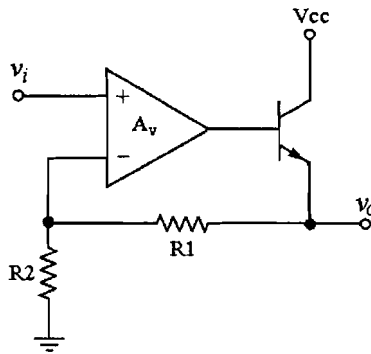


Figure P5

6. (a) Analyze the operation of an instrumentation amplifier shown in Figure P6. (b) Describe its characteristics. (15%)

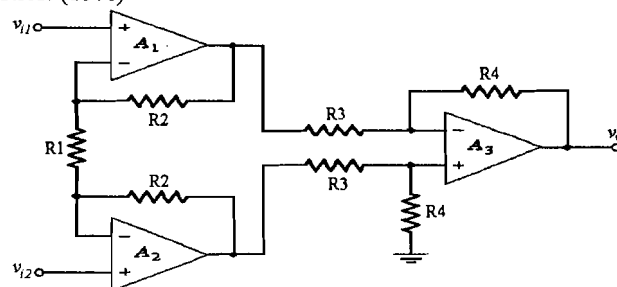


Figure P6

