國立彰化師範大學103學年度碩士班招生考試試題

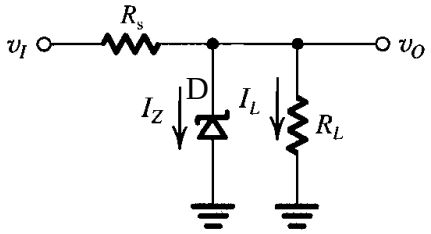
系所：電子工程學系(甲組選考乙、乙組選考丙)、
資訊工程學系積體電路設計碩士班(選考乙)、
電信工程學研究所(選考乙)　　科目：電子學

☆☆請在答案紙上作答☆☆　　

1. The shunt regulator circuit uses a Zener diode D which has $V_z = 7.2\,\text{V}$ at $I_z = 10\,\text{mA}$. The dynamic resistance is 5 Ω. The minimum value of v_I is 16 V, the maximum value of I_L is 25 mA.

(a) If the minimum allowable I_Z is 5 mA, find the maximum usable value of R_S. (10%)

(b) Find the line regulation $\frac{\Delta v_O}{\Delta v_I}$ and the load regulation $\frac{\Delta v_O}{\Delta I_L}$. (10%)



2. What is the difference between a p-n diode and a Schottky diode? (10%)

3. Explain the following terminologies.

(a) Channel length modulation. (5%)

(b) Avalanche breakdown. (5%)

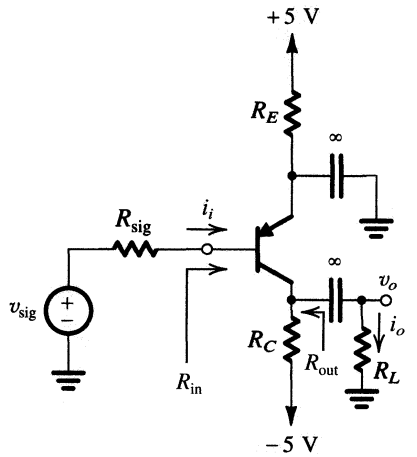
4. In the circuit shown below, v_{sig} is a small sine-wave signal with zero average and $R_{sig} = 2\,\text{k}\Omega$. The transistor β is 100 and $V_A = 50\,\text{V}$. ($V_T = 25\,\text{mV}$)

(a) Find the value of R_E to establish a dc emitter current of 1 mA. (5%)

(b) Find the value of R_C to establish a dc collector voltage of -2 V. (5%)

(c) Find R_{in} and R_{out}. (10%)

(d) For $R_L = 5\,\text{k}\Omega$, determine the overall voltage gain v_o / v_{sig}. (10%)



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5. The current mirror circuit shown below has $L_1 = L_2 = 1\,\mu\text{m}$, $W_1 = 1\,\mu\text{m}$, $V_t = 1\,\text{V}$, $\mu_n C_{ox} = 200\,\mu\text{A/V}^2$, $V_A = 20\,\text{V}$, $V_{DD} = 5\,\text{V}$

(a) If we want to establish a reference current, $I_{REF} = 100\,\mu A$, calculate the value of V_{GS}, and *R*. (10%)

(b) Find the value of W_2 that will result in I_{D2} current equal to 250 μA when the drain voltage is equal to the voltage at the gate. (10%)

(c) If the drain voltage increases by 5 V, find the resulting value of I_{D2}. (10%)