

## 國立台灣科技大學九十五學年度碩士班招生試題

系所組別：電子工程系碩士班丙組

科目：電子學

總分 100 分

1. Please sketch the electrical resistivity as a function of temperature for a metal and an intrinsic semiconductor material, respectively, and why? (10%)
2. Please derive out the form of Fermi-Dirac distribution. (10%)
3. Please sketch the electrical conductivity as a function of temperature for a Si material phosphorus-doped with  $1 \times 10^{16} \text{ cm}^{-3}$ , and why? (10%)
4. In the quantum state  $n$  of the harmonic oscillator, please find the product of the position and the momentum uncertainties (i.e.  $\Delta x \Delta p$ ). (10%)
5. Considering a typical Si npn transistor, please sketch the  $\beta$  ( $I_c/I_b$ ) value as a function of  $I_c$  (collector current), both in log scale, and why? (10%)

107

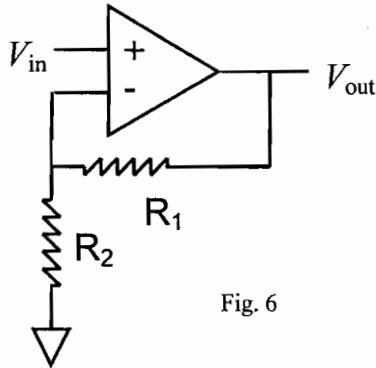


國立台灣科技大學九十五學年度碩士班招生試題

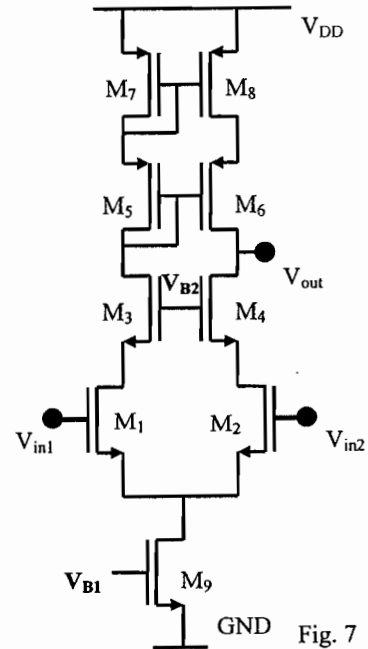
系所組別：電子工程系碩士班丙組

科目：電子學

6. (10%) For the circuit shown in Fig. 6 with  $R_1/R_2=9$ , find the minimum differential gain of the OPAMP to make the close loop gain error (the deviation from nominal close loop gain) less than 1%. Assume that the other parameters of the OPAMP are ideal.



7. (25%) Refer to the circuit in Fig 7  
 (a) Use small signal models to deduce or estimate the voltage gain  $V_{out}/(V_{in1}-V_{in2})$ . (15%)  
 (b) If  $V_{out}$  is connected  $V_{in2}$  to form a unity gain buffer, deduce or estimate the output swing. (10%)



8. (15%) Under the maximum output swing condition, find the maximum power conversion efficiency of the amplifier shown in Fig. 8. Assume  $L \gg 1$ ,  $R_E$  &  $R_{coil}$  (of coil  $L$ )  $\ll 1$  and the output current is sinusoidal.

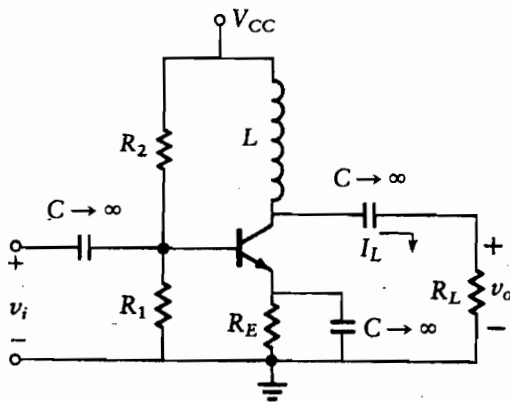


Fig. 8



108