



國立臺灣海洋大學一〇〇學年度研究所碩士班暨碩士在職專班入學考試試題

考試科目：電子學

系所名稱：光電科學研究所碩士班不分組

※可使用計算器

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

1. An amplifier has a voltage gain of 200 V/V and a current gain of 2000 A/A. Express the voltage, current, and power gains in decibels. (10%)
2. For the circuit in Fig. 1, if $\beta = 100$, $V_E = -0.7$ V, find I_E , I_B , I_C , and V_C . (16%)

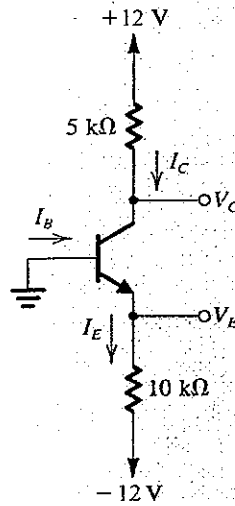


Fig. 1

3. For the circuit in Fig. 2, let $V_{CC} = 12$ V, $I = 100$ mA, and $R_L = 100$ Ω . If the output voltage is a 10-V-peak sinusoid, find the following: (a) the power delivered to the load; (b) the average power drawn from the supplies; (c) the power-conversion efficiency. Ignore the loss in Q_3 and R . (12%)

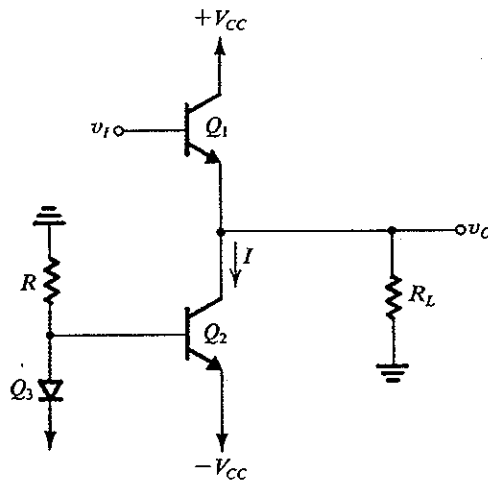


Fig. 2

4. A BJT differential amplifier is biased from a 2-mA constant-current source and includes a $75\text{-}\Omega$ resistor in each emitter. The collectors are connected to V_{CC} via $5\text{-k}\Omega$ resistors. A differential input signal of 0.1 V is applied between the two bases. (a) Find the signal current in the emitters (i_e) and the signal voltage v_{be} for each BJT. (b) What is the total emitter current in each BJT? (c) What is the signal voltage at each collector? Assume $\alpha = 1$. (d) What is the voltage gain realized when the output is taken between the two collectors? Assuming the circuit is operating at room temperature. (20%)
5. Assuming the op amp to be ideal, it is required to design the circuit shown in Fig. 3 to implement a current amplifier with gain $i_L/i_I = 30\text{ A/A}$. (a) Find the required value for R . (b) If $R_L = 1\text{ k}\Omega$ and the op amp operates in an ideal manner so long as v_O is in the range $\pm 12\text{ V}$. What range of i_I is possible? (c) What is the input resistance of the current amplifier? If the amplifier is fed with a current source having a current of 1 mA and a source resistance of $10\text{ k}\Omega$, find i_L . (20%)

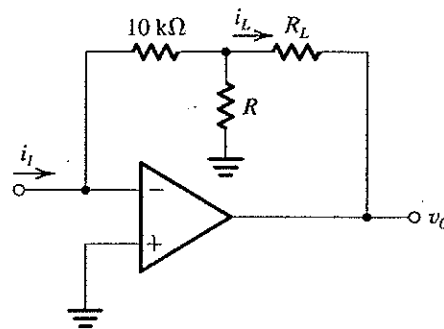


Fig. 3

6. The circuit in Fig. 4 is required to provide a three-segment approximation to the nonlinear i - v characteristic, $i = 0.1 v^2$, where v is the voltage in volts and i is the current in milliamperes. Find the values of R_1 , R_2 , and R_3 such that the approximation is perfect at $v = 2\text{ V}$, 4 V , and 8 V . Calculate the error in current value at $v = 3\text{ V}$, 5 V , 7 V , and 10 V . Assume ideal diodes. (22%)

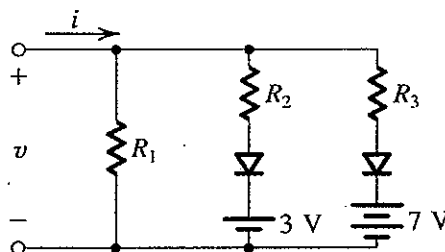


Fig. 4