國立成功大學

110學年度碩士班招生考試試題

編　號：128

系　所：系統及船舶機電工程學系

科　目：電子學

日　期：0202

節　次：第 2 節

備　註：可使用計算機

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※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1、A uniform bar of n-type silicon of 2μm length has a voltage of 1V applied across it. If $N_D=10^{16}/cm^3$ and $\mu_n=1350$ cm/V.s. (a) Find the electron drift velocity, (b) Calculate the time it takes an electron to cross the 2μm length, (c) Calculate drift-current density. (15%)

2、(a) Sketch the transfer characteristic v_o versus v_I for the limiter circuits shown in Fig. 1(a). All diodes begin conducting at a forward voltage drop of 0.5 V and have voltage drops of 0.7 V when conducting a current $i_D \geq 1$ mA. (b) For the circuits in Fig. 1(b), each utilizing an ideal diode (or diodes), sketch the output for the input shown. Label the most positive and most negative output levels. Assume CR>>T. (20%)

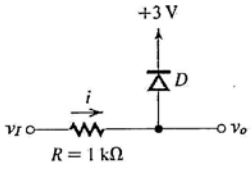
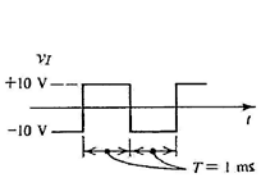


Fig. 1(a)



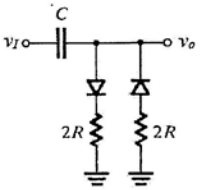


Fig. 1(b)

3、(a) We want to analyze the circuit of Fig. 2 to determine the voltage at all nodes and the currents through all branches. Assume β=100. (b) If the transistor in the circuit of Fig. 2 is replaced with another half the value of β=50, find the new value of I_C, and express in I_C as a percentage. (c) Consider the circuit in Fig. 2. At V_{CE}=1V, V_{BE} is adjusted to yield a collector current of 1mA. Then, while V_{BE} is kept constant, V_{CE} is raised to 11V. Find the new value of I_C. For this transistor, V_A=100V (15%)

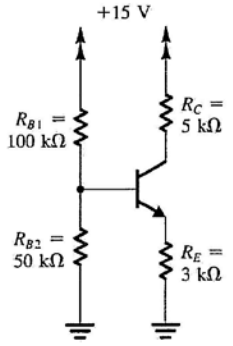


Fig. 2

4、Consider the circuit shown in Fig. 3. First, note diodes D_1 and D_2 are included to make design (and analysis) easier and to provide temperature compensation for the emitter—base voltages of Q_1 and Q_2. Second, note resistor R, whose purpose is to provide negative feedback. Using $|V_{BE}|$ and V_D = 0.7 V independent of current, and $\beta=\infty$, find the voltages V_{B1}, V_{E1}, V_{C1}, V_{B2}, V_{E2}, and V_{C2}, initially with R open-circuited and then with R connected. Repeat for $\beta=100$, with R open-circuited initially, then connected. (20%)

5、The CS amplifier of Fig. 4. Assume the MOSFET is specified to have V_t=1V, k_n=4mA/V^2, λ=0, and V_A=100V. (a) Design for I_D=0.5mA, V_S=3.5V, V_D=6V and V_{DD}=15V. Specify the values of R_S and R_D. If a current of 2μA is used in the voltage divider, specify the values of R_{G1} and R_{G2}. Give the values of the MOSFET parameter g_m and r_o at the bias point. (b) Determine R_{in}, R_o, and the overall voltage gain A_V when R_{sig}=100kΩ and R_L=20k (30%)

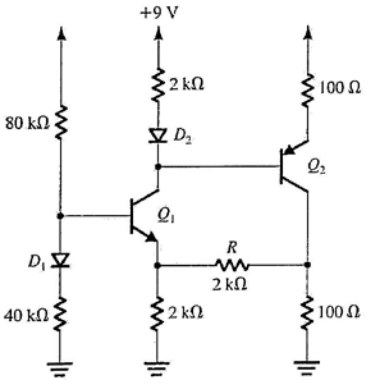


Fig. 3

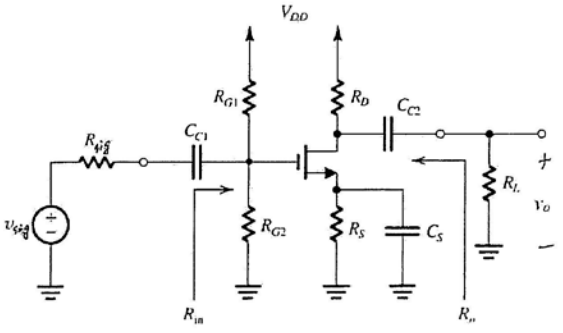


Fig. 4