

1. The circuit shown in Fig. 1 is a BJT monostable multivibrator. When conducting, the transistors are saturated.
- (a) Sketch the base voltage of Q_1 , v_{B1} , from $t = 0^-$, just prior to the application of the trigger, to $t = T^+$, just after the circuit has returned to its stable state. (7分)
- (b) Derive an expression for T , the pulse width. (8分)
2. The circuit shown in Fig. 2 is a NAND gate.
- (a) If $\beta = 25$, what is the fan-out? (7分)
- (b) What is the average power dissipated by the gate assuming $Y = V(1)$ 50 percent of the time? (8分)
3. The transistors Q_1 and Q_2 in Fig. 3 are identical and have $\beta = 200$.
- (a) Determine I_{C1} and I_{C2} . (8分)
- (b) Find R_2 so that $V_o = 6V$. (7分)
4. For the circuit shown in Fig. 4, both diodes are identical, conducting 10 mA at 0.7 V and 100 mA at 0.8 V. Find the value of R , for which $V_o = 50$ mV. (15分)
5. The transistors of the circuit in Fig. 5 have the following parameters: For Q_1 , $I_{DSS} = 4$ mA, $V_p = -2$ V; for Q_2 , $|V_{BE}| = 0.7$ V, $\beta = 100$.
- (a) Find the values of R_D , R_E , R_L to operate Q_1 at $I_D = 1$ mA and Q_2 at $I_C = 9$ mA and to establish a dc voltage of +13.5 V at the drain of Q_1 . Assume that V_s has a zero dc component. (10分)
- (b) Calculate the value of $A_f = V_o/V_s$. (10分)
6. Design a Butterworth filter that meets the following low-pass specifications:
 $f_p = 10$ kHz, $f_s = 15$ kHz, $A_{max} = 2$ dB and $A_{min} = 15$ dB.
- (a) Find the required order N , the natural modes, and transfer function $T(s)$. (15分)
- (b) What is the attenuation provided at 20 kHz. (5分)

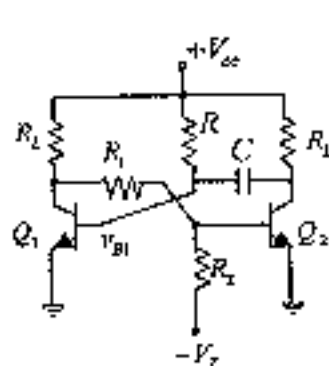


Fig. 1

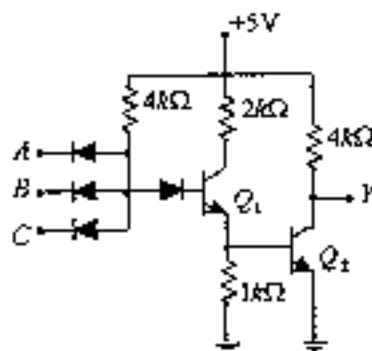


Fig. 2

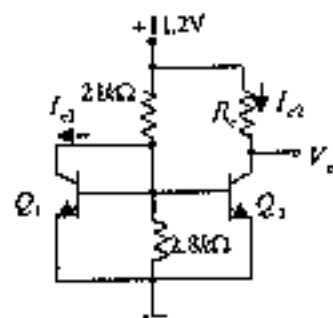


Fig. 3

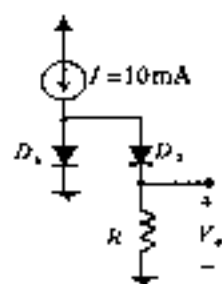


Fig. 4

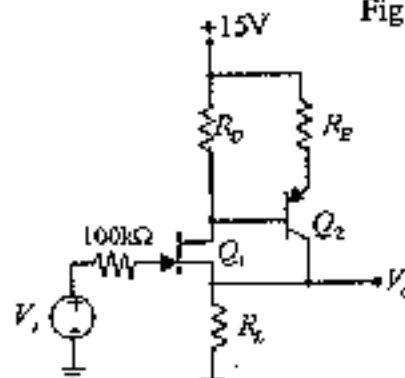


Fig. 5