



本試題共 5 題，每題得分如各題中所示，共計 100 分，請依題號作答並將答案寫在答案卷上，違者不予計分。

1. (10 分) Suppose in Fig. P1, the diodes carry a current of 4 mA and the load, a current of 18 mA. If the load current increases to 19 mA, what is the change in the total voltage across the three diodes? Assume R_1 is much greater than $3r_d$ and the thermal voltage (V_T) is 26 mV.

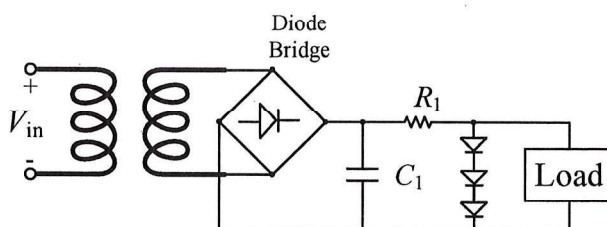


Fig. P1

2. Compute the input resistance of the circuits depicted in Fig. P2. Assume $V_A = \infty$.

- (a) (5 分) find the input resistance of R_{in1}
 (b) (10 分) find the input resistance of R_{in2}
 (c) (10 分) find the input resistance of R_{in3}

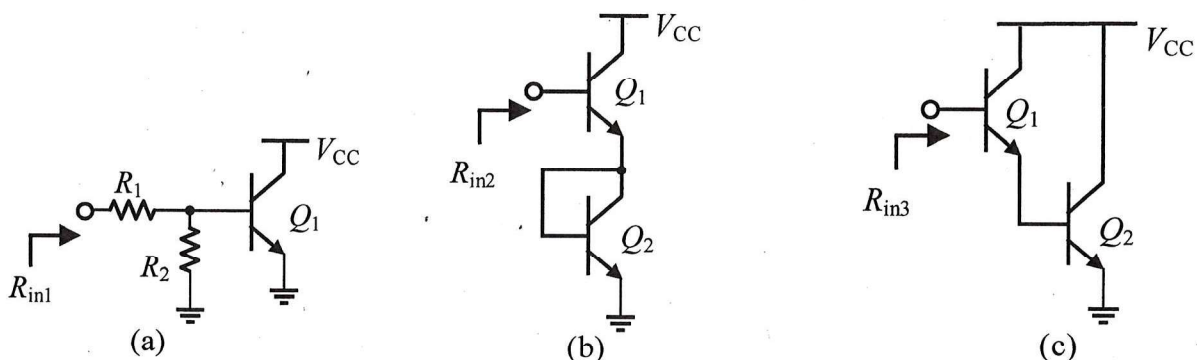


Fig. P2

3. (15 分) The integrator of Fig. P3 must operate with frequencies as low as 1.2 kHz while providing an output offset of less than 19 mV with an OPA offset of 3 mV. Determine the required values of R_1 and R_2 if $C_1 \leq 120$ pF.

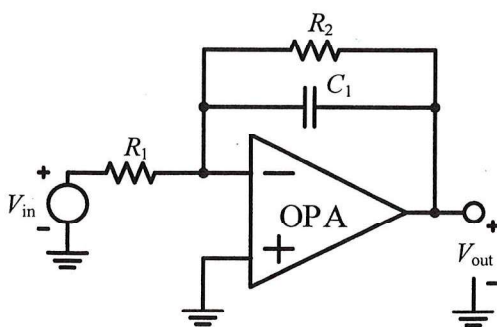


Fig. P3



4. Fig. P4 shows a negative feedback loop circuit.

- (a) (10 分) Find the loop gain $A\beta$ for which the sensitivity of closed-loop gain to open loop gain $(1 + A\beta)^{-1}$ is -20 dB.
- (b) (10 分) What is the $A\beta$ value when the sensitivity becomes 1/2?

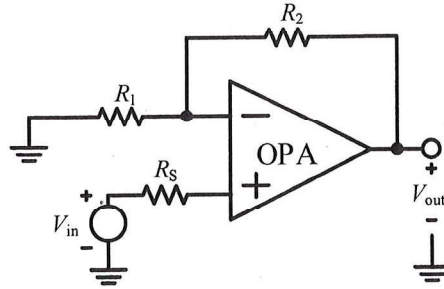


Fig. P4

5. As shown in the circuit diagram in Fig. P5, if its voltage gain is 0.8, the transistor channel's width-to-length ratio is 200 ($W/L = 200$). Its transistor parameters are: $\mu_n C_{ox} = 200 \mu\text{A}/\text{V}^2$, $R_S = 0.5 \text{ k}\Omega$, and $V_{TH} = 0.4 \text{ V}$, $\lambda = 0$, then:

- (a) (10 分) What is the name of this circuit?
- (b) (10 分) What should the transconductance g_m from the MOS small signal model be?
- (c) (5 分) What should the I_D current be in this case?
- (d) (5 分) What should be the appropriate V_{Bias} ?

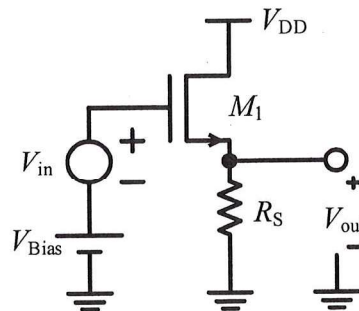


Fig. P5