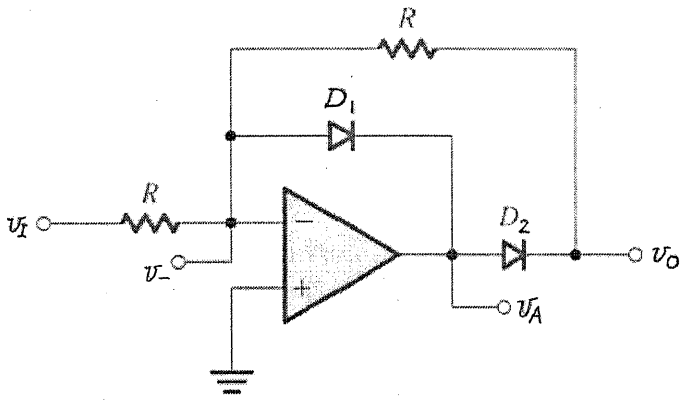
逢甲大學101學年度碩士班招生考試試題 編號：069 科目代碼：

科目	電子學	適用系所	電子工程學系固態電子組、電路與系統組	時間	100 分鐘

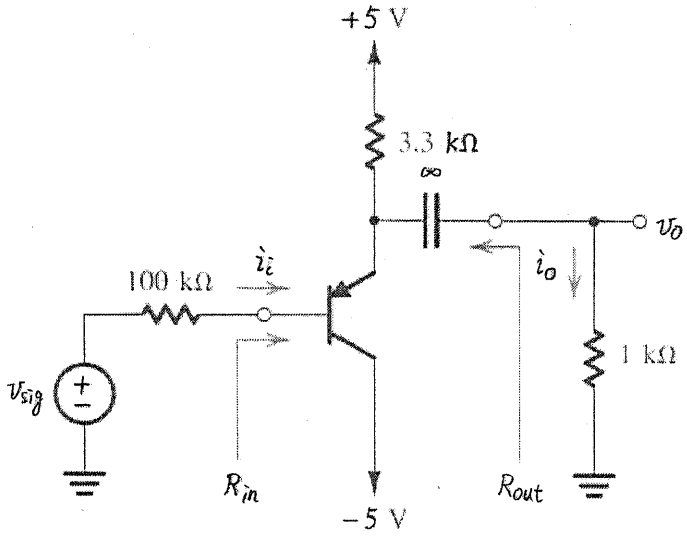
※請務必在答案卷作答區內作答。 共 3 頁第 1 頁

1. A p-n silicon step junction diode has $N_A = 10^{17}\ \text{cm}^{-3}$, $N_D = 10^{16}\ \text{cm}^{-3}$, $D_n = 30\ \text{cm}^2/\text{s}$, $D_p = 10\ \text{cm}^2/\text{s}$, $\tau_n = \tau_p = 0.1\ \mu\text{s}$, $n_i = 1.5\times10^{10}\ \text{cm}^{-3}$, $A = 5\times10^4\ \mu\text{m}^2$, and $\varepsilon_s = 11.7\varepsilon_0$. Assume that the forward current is $I = 0.5\ \text{mA}$. (a) Find the built-in potential voltage V_0. (5%) (b) Find the forward voltage V. (5%) (c) Find the diffusion capacitance C_D. (5%) (d) Find the junction capacitance C_J (Assume that $C_J \approx 2C_{J0}$ where C_{J0} is the junction capacitance with no bias). (5%)

2. The opamp in the following figure is ideal with output saturation levels of $\pm 10\ \text{V}$. The diodes have a constant 0.7 V drop when conducting. Find v_-, v_A, and v_O for (a) $v_I = 2\ \text{V}$. (7%) (b) $v_I = -2\ \text{V}$. (7%)



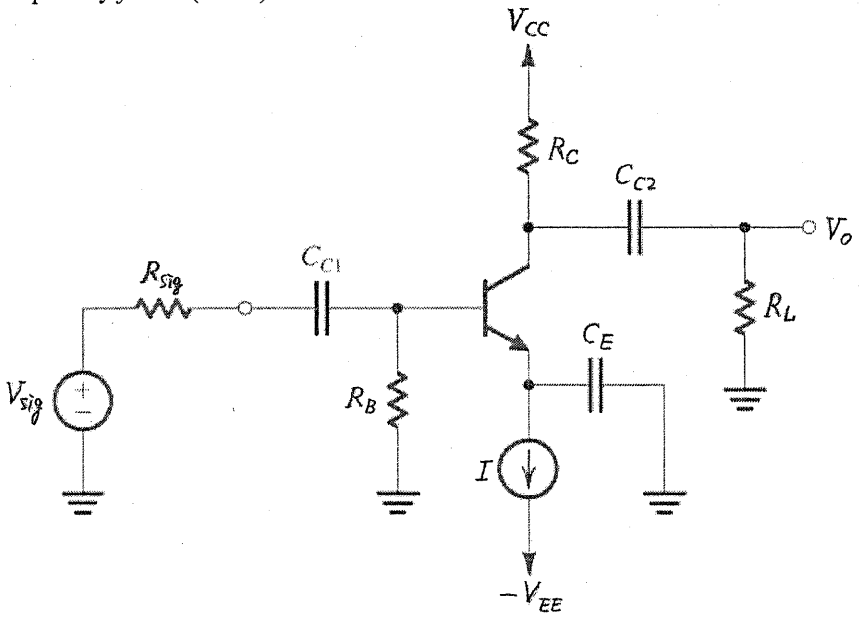
3. Consider the emitter follower shown below. The BJT has $\beta = 100$ and $r_o = \infty$. (a) Find the dc emitter current I_E. (4%) (b) Find R_{in}, R_{out}, i_o/i_i, and v_o/v_{sig}. (12%)



4.Consider the circuit shown below with the following cases: $Vcc=VEE=10V$,$I=1mA$
$RB=100K\Omega$,$RC=8K\Omega$,$Rsig=RL=5K\Omega$,$\beta=100$,$VA=100V$,$Cu=1pF$,$fT=800MHz$,
Please calculate

(a) Midband voltage gain AM=? ($Vo/Vsig$) (10%)

(b) Upper -3dB frequency fH=? (10%)

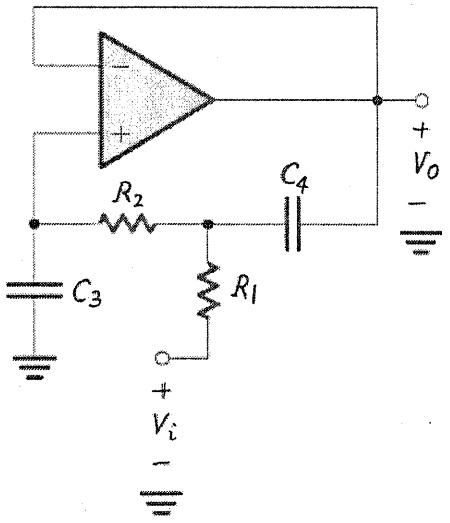


(a)

5. Analyze the circuit shown below to answer the following questions

(1) The transfer function $Vo(s)/Vi(s)$ (5%) (3) The pole frequency ωo (5%)

(2) The pole quality factor Q (5%) (4)The DC gain=? (5%)



(c)

6. Consider the bias circuit shown below with the geometric ratio (W/L)8=(W/L)9=(W/L)10=(W/L)11=(W/L)13=20,and (W/L)12=80.Also,we have $\mu_n C_{ox} = 90uA/v^2$, answer the following questions

(1) Find the value of *RB* that makes bias current *IB*=10uA (5%)

(2) Find the transconductance *gm12* (5%)