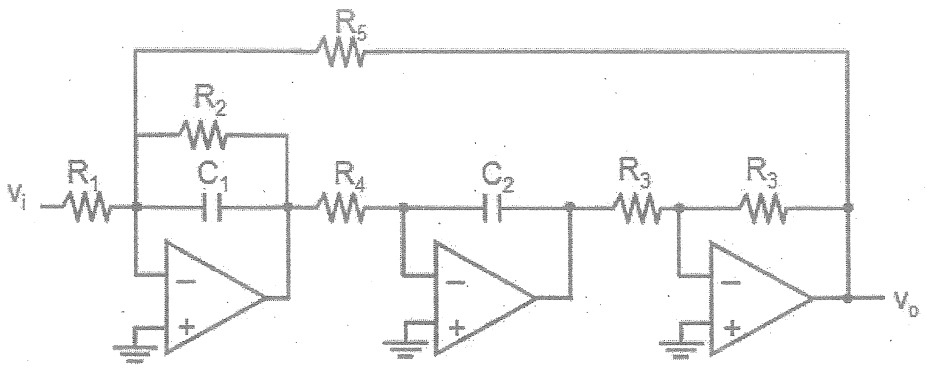
97學年度奈米工程暨微系統研究所系（所）＿＿＿＿＿＿組碩士班入學考試

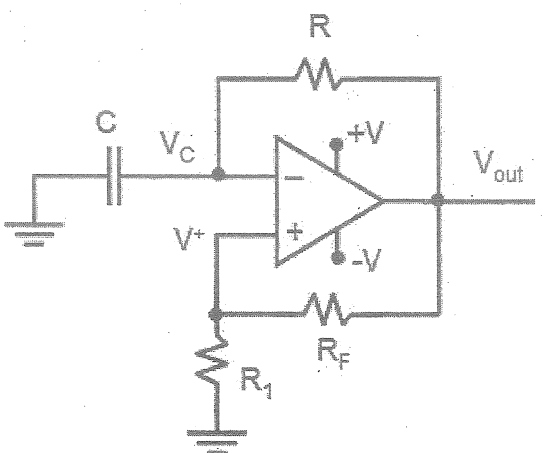
科目＿電子學＿科號＿1806＿共＿3＿頁第＿1＿頁 *請在試卷【答案卷】內作答

*本科得使用非程式型(不具儲存功能)計算器

1. (20%) The active biquad filter as shown contains passive elements and ideal operational amplifiers. Please derive the transfer functions of $v_o(s)/v_i(s)$.



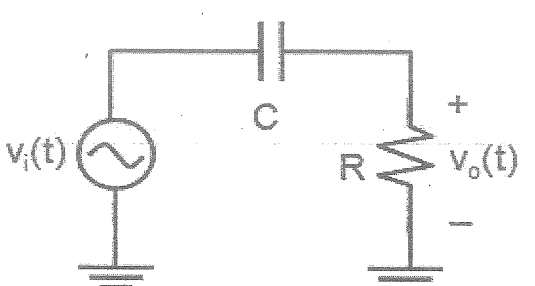
2. (15%) The relaxation oscillator as shown contains passive elements and an ideal operational amplifier. Please draw the waveforms of V_c and V_{out}, and derive the oscillation frequency (Note: assume that the maximum and minimum values of V_{out} are V_{max} and $-V_{max}$, respectively).



3. For the circuit as shown:

(a) (10%) Plot the frequency response (magnitude and phase) of $v_o(j\omega)/v_i(j\omega)$.

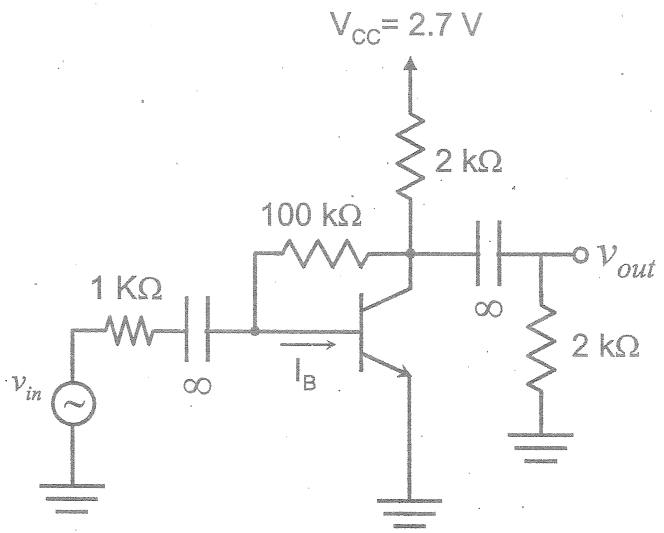
(b) (5%) Given that $v_i(t)$ is the unit step function, please derive the output $v_o(t)$.



4. (10%) For the circuit shown below:

(a) (5%) What is the feedback type used in this circuit? And what is the feedback factor of this circuit?

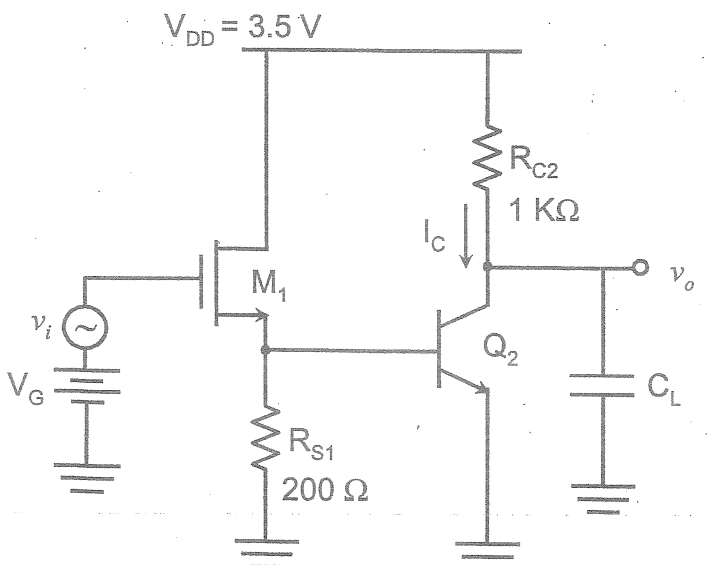
(b) (5%) Assuming β of the BJT is 49, determine I_B.



5. (20%) A two-stage amplifier is designed as shown below (I_C= 1 mA, C_L= 1 pF):

(a) (10%) Determine the overall low-frequency small-signal gain (v_o/v_i)

(b) (10%) Find the 3-dB frequency f_H of the amplifier.



MOS	BJT
$\mu_n C_{ox}$= 100 μA/V²	β= 100
V_t= 0.7 V	V_A= 50 V
C_{gs}= 0.5 pF	C_π= 0.2 pF
C_{gd}= 0.3 pF	C_μ= 0.1 pF
V_A= 50 V	
W/L= 100	

6. (20%) For an active-loaded MOS differential pair, where $\mu_n C_{ox}$= 100 μA/V^2, $\mu_p C_{ox}$= 50 μA/V^2, (W/L)= 100, $|V_A|$= 20 for all devices, I_{bias}= 100 μA, the equivalent load capacitance= 0.1 pF. The resistance and capacitance looking into the current source are 200 kΩ and 1.0 pF, respectively:
   (a) (10%) Determine low-frequency common-mode rejection ratio CMRR. Express your answer by dB.
   (b) (10%) Plot CMRR (dB) vs. frequency (log scale). Mark the important frequencies and the slopes.