國立臺北科技大學九十八學年度碩士班招生考試

系所組別：2230 電腦與通訊研究所丙組

第二節　電子學　試題

注意事項：

1.本試題共五題，配分共 100 分。
2.請標明大題、子題編號作答，不必抄題。
3.全部答案均須在答案卷之答案欄內作答，否則不予計分。

(請依序於答案卷之答案欄內作答)

一、 **Please employ one 1:1 transformer, two PN junction diodes, and two capacitors to design a voltage-doubling circuit which delivers a dc voltage, V_{out}, equal to twice the transformer peak voltage, V_p, assuming that the forward cut-in voltages of the two diodes are both zero. (20%)**

二、 **Please show in detail that the transconductance of a depletion MOSFET operating in the saturation region is given by $g_m = (\frac{2}{|V_P|})\sqrt{I_{DSS} I_{DS}}$ where I_{DS} is the drain-to-source current, I_{DSS} is the value of the I_{DS} current for $V_{GS} = 0$, and V_P is the pinch-off voltage for the depletion MOSFET. (20%)**

三、 **Figure 1 is a Sallen-Key filter. Please show in detail that the transfer function of filter network is given by $H(s) = \frac{V_{out}(s)}{V_{in}(s)} = \frac{\omega_0^2}{s^2 + 2\omega_0 s + \omega_0^2}$ where $\omega_0 = \frac{1}{RC}$. (20%)**

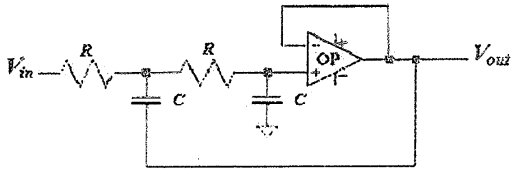

Figure 1

四、 **Many oscillator circuits fall into the general form shown in Figure 2. Assuming that the amplifying device with an open-circuit voltage gain of $-A_v$ exhibits infinitely high input resistance, $R_{in} = \infty$, but has a nonzero output resistance, $R_{out} \neq 0$, and $Z_1 = jX_1$, $Z_2 = jX_2$, $Z_3 = jX_3$, please prove in detail that the circuit in Figure 2 will oscillate at the resonant frequency that satisfies this oscillation condition $(X_1 + X_2 + X_3) = 0$. (20%)**

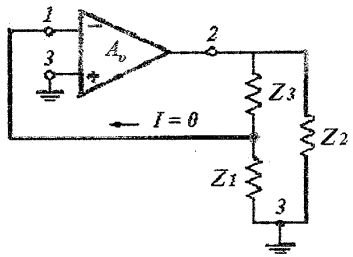

Figure 2

五、 **The truth table of the *J-K* FLIP-FLOP is specified in Table 1. Please design the *J-K* FLIP-FLOP with four NAND logic gates. (20%)**

Table 1

Clock	J_n	K_n	Q_{n+1}	$\overline{Q_{n+1}}$
1	0	0	Q_n	$\overline{Q_n}$
1	0	1	0	1
1	1	0	1	0
1	1	1	$\overline{Q_n}$	Q_n