國 立 臺 北 科 技 大 學

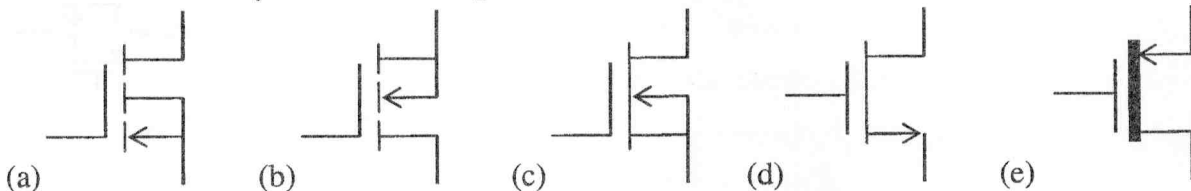## 九十四學年度電腦與通訊研究所碩士在職專班入學考試

丁組：電子學 試題

填准考證號碼

注意事項：

1. 本試題共【八】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
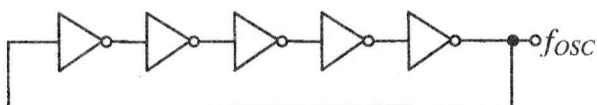

Problem 1　[2% x 5 = 10%]

Mark each circuit symbol that belongs to which one of MOS elements.
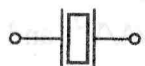

(a)　　　　(b)　　　　(c)　　　　(d)　　　　(e)

Problem 2　[(a) 8%, (b) 8%]

(a) An inverter has a 3-pF capacitance load and is operated at a 3.3V power supply. If it is switched the frequency at 200MHz, find the dynamic power dissipation.

(b) Five identical inverters are constructed a ring oscillator shown as the following figure. If the propagation delay of each inverter is specified to be 400ps, find the oscillated frequency f_{osc}.
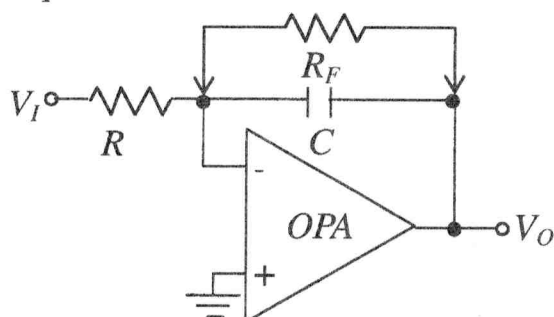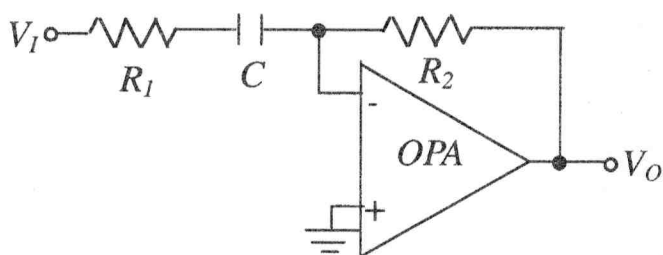
Problem 3 [12%]

A crystal symbol is shown as the following figure. Please present the equivalent circuit and the formulas of series resonance at ω_s and parallel resonance at ω_p, and explain which resonance is dominant to the resonance frequency ω_o.

Problem 4 [12%]

A Miller integrator is shown as the following figure. Explain the effects that the resistance R_F is required and not.

Problem 5 [12%]

A first-order filter is shown as the following figure. Let R_1=10KΩ, R_2=150KΩ, and C=0.001μF, find the high-frequency gain and corner frequency ω_o, and show the Bode plot.
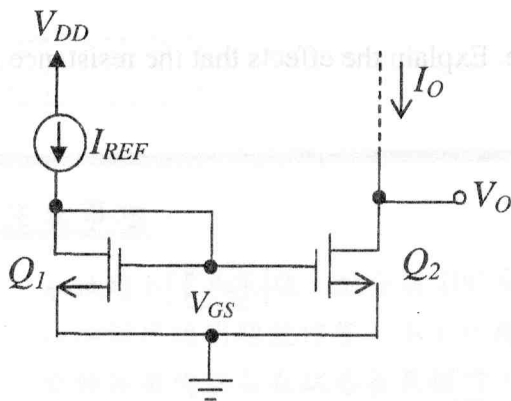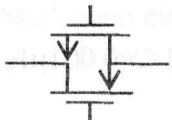

注意：背面尚有試題

Problem 6　[16%]

A current mirror is shown as the following figure. Two devices Q_1 and Q_2 that W/Ls are $100\mu m/10\mu m$ and $250\mu m/10\mu m$, respectively, and they have $V_t = 1V$, $k'_n = 20\mu A/V^2$, and $V_A = 1/\lambda = 200V$, where λ is the channel-length modulation. Given $V_{DD} = 5V$ and $I_{REF} = 100\mu A$, find the V_{GS}, output current I_O, output resistance R_O, and the output current I_O at $V_O=5V$.

Problem 7　[12%]

Design a 4-to-1 multiplexer with transmission gates as shown below and inverters.

Problem 8　[10%]

Design a circuit that can linearly convert the input voltage V_I of 0.4V-1.2V to the output voltage V_O of 0-3.2V.