國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：工程數學
考試時間：100 分鐘

系所：
電機工程學系(光電組)

是否使用計算機：是

本科原始成績：100 分

注意事項：請先作答微分方程試題，並依照題號順序作答。

一、微分方程（50 %）

1. (10 %) Solve $\left(\frac{1}{1+y^2}+\cos x-2xy\right)\frac{dy}{dx}=y\left(y+\sin x\right),\ y\left(0\right)=1.$

2. (10 %) Solve $\frac{dy}{dx}=\frac{3x+2y}{3x+2y+2},\ y\left(-1\right)=-1.$

3. (10 %) Solve $y''-4y=\left(x^2-3\right)\sin 2x.$

4. (10 %) Solve $y'''-2y''+y'=xe^x+5,\ y\left(0\right)=2,\ y'\left(0\right)=2,\ y''\left(0\right)=-1.$

5. (10 %) Use the Laplace transform to solve

$$y'''+2y''-y'-2y=\sin 3t,\ y\left(0\right)=0,\ y'\left(0\right)=0,\ y''\left(0\right)=1.$$

二、線性代數（50 %）

6. (9 %) Indicate whether the following matrices are Hermitian, skew-Hermitian, or unitary.

(a) $\begin{pmatrix}0 & i\\ i & 0\end{pmatrix}$ (b) $\begin{pmatrix}4 & i\\ -i & 2\end{pmatrix}$ (c) $\begin{pmatrix}\frac{1}{\sqrt{2}} & \frac{i}{\sqrt{2}}\\ -\frac{i}{\sqrt{2}} & -\frac{1}{\sqrt{2}}\end{pmatrix}$

7. (13 %) $\mathbf{X}'=\begin{pmatrix}1 & 1 & 0\\ 1 & 1 & 0\\ 0 & 0 & 3\end{pmatrix}\mathbf{X}+\begin{pmatrix}e^t\\ e^{2t}\\ te^{3t}\end{pmatrix}$, find the general solution of **X**.

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8. (28 %) A matrix $\mathbf{A} = \begin{pmatrix} 15 & 7 & -7 \\ -1 & 1 & 1 \\ 13 & 7 & -5 \end{pmatrix}$, determine

(a) the characteristic polynomials,
(b) eigenvalues,
(c) eigenvectors, and
(d) the matrix $\mathbf{A}^3$.

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：近代物理
考試時間：100 分鐘

系所：
電機工程學系(光電組)

是否使用計算機：是

本科原始成績：100 分

一、請舉例說明光具有粒子性(particle like)的實驗，並說明光子動量(momentum)與波長(wave length)的關係。(10%)

二、請說明一無限位能井系統(infinitive energy well)的能量運算元(energy operator)、能量固有函數(energy eigen function)、能量固有值(energy eigen value)三者的關係，並說明任一狀態函數(state function)與其能量平均值(energy average value)的關係。(10%)

三、一質量爲 m 的自由粒子

(1). 寫出其薛丁格方程(Schrodinger equation)及其波函數(wave function)，(10%)

(2). 寫出能量(energy)與動量(momentum)的平均值 (10%)

四、請說明原子中電子的能階結構(atomic energy levels)與元素週期表(periodic table of atoms)的關係。(15%)

五、請舉一實驗說明電子的自旋量子化(electron spin quanta)現象。(15%)

六、請說明自發輻射(spontaneous emission)與激發輻射(stimulated emission)的差異。(10%)

七、請舉例說明一量子力學系統能量與時間誤差的測不準(uncertainty)關係 $\Delta E \cdot \Delta t \geq \frac{\hbar}{2}$ (10%)

八、一電子系統中，請寫出平衡狀態之電子能量的機率分佈函數(distribution function) F(E) (10%)

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：計算機概論
考試時間：100 分鐘

系所：
電機工程學系(計算機組)

是否使用計算機：是

本科原始成績：100 分

1. 請說明下面專有名詞的意義(請勿僅有英翻中)。
   (5%) (a) Addressing mode
   (5%) (b) Graphics processing unit
   (5%) (c) Tablet PC
   (5%) (d) The von Neumann model

2. (2%) (a)請寫出圖 1 電路的名稱。
   (8%) (b)請描述該電路的運作情形。

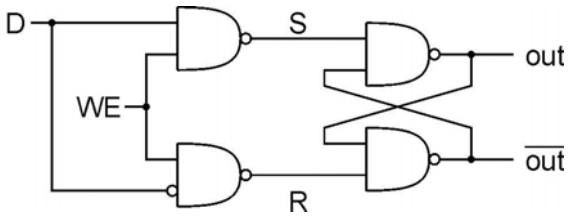
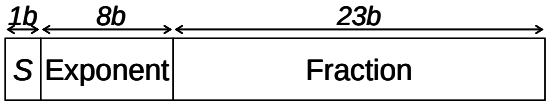


圖 1

3. 數字系統
   (5%) (a) 請計算 2 的補數 11 與 01010101 相加，答案以十進位表示。
   (5%) (b) 請將$(376.AC)_{16}$轉成八進位數字。
   (5%) (c) 請計算 x00FF **XOR** x325C，答案以十六進位表示。
   (5%) (d) 請將$(18.75)_{10}$轉成IEEE 754 浮點數格式(圖 2)，並將答案以十六進位表示。



$$N = (-1)^S \times 1.\text{fraction} \times 2^{\text{exponent}-127},\ 1 \le \text{exponent} \le 254$$

圖 2

4. 假設某二元樹，利用中序追蹤法可得輸出順序為 **CBAEDGHFI**；若利用前序追蹤法可得輸出順序為 **ABCDEFGHI**。
   (5%) (a)請繪出此二元樹。
   (5%) (b)請寫出此二元樹的後序追蹤輸出順序。

5. (10%)請用 Prim's Algorithm，繪出圖 3 的 minimum cost spanning tree。

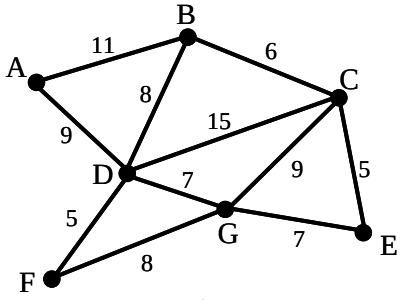


圖 3

背面尚有試題

科目：計算機概論
考試時間：100 分鐘

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6. (10%) How many times is the **print** statement executed for the following program segment? (Here, *i*, *j*, *k*, and *m* are integer variables)

```
for i = 1 to 10 do
  for j = 1 to i do
    for k = 1 to j do
      for m = 1 to k do
        print (i * j) + (k * m)
```

7. Consider the following C program.

```
int fun(int *i){
  *i += 5;
  return 4;
}

void main(void){
  int x = 3;
  x = x + fun(&x);
}
```

What is the value of `x` after the assignment statement in `main`, assuming

(5%) (a) operands are evaluated left to right.

(5%) (b) operands are evaluated right to left.

8. (10%)請問底下的程式，執行結果為何？

```
#include<stdio.h>
int recursive_call(int, int);

int main(void){

  int m = 8, n = 5;
  int answer = 0;
  answer = recursive_call(m,n);
  printf("The result is %d\n", answer);
  return 0;
}

int recursive_call(int m, int n){
  if(m == n) return 1;
  if(n == 1) return m;
  return recursive_call(m-1, n-1) - recursive_call(m-1, n);
}
```

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：工程數學
考試時間：100 分鐘

系所：
電機工程學系(通訊組)

是否使用計算機：是

本科原始成績：100 分

共十題，每題十分。請依題號順序作答，否則酌予扣分。

1. Determine the kernel and range of each of the following linear transformations from R^3 into R^3.

   (a) $L(\mathbf{x}) = (x_1,\ x_2,\ 0)^T$.

   (b) $L(\mathbf{x}) = (x_1,\ x_1,\ x_1)^T$.

2. Find the **QR**-decomposition of **A** under the Euclidean inner product.

$$\mathbf{A} = \begin{bmatrix} 2 & 0 & 2 \\ 2 & 2 & -1 \\ 1 & -1 & -2 \end{bmatrix}$$

3. Find a matrix **P** that orthogonally diagonalizes **A**, and determine $\mathbf{P}^{-1}\mathbf{AP}$.

$$\mathbf{A} = \begin{bmatrix} -1 & 2 & 0 \\ 2 & 0 & 2 \\ 0 & 2 & 1 \end{bmatrix}$$

4. Let $T : R^3 \to R^3$ be defined by $T(x_1, x_2, x_3) = (x_1 - x_2, x_2 - x_1, x_1 - x_3)$.

   (a) Find the matrix for T with respect to the basis $B = \{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$, where

   $\mathbf{v}_1 = (1,\ 0,\ 1),\ \mathbf{v}_2 = (0,\ 1,\ 1),\ \mathbf{v}_3 = (1,\ 1,\ 0)$

   (b) Find $[T(\mathbf{x})]_B$ where $\mathbf{x} = (x_1,\ x_2,\ x_3)$ in R^3.

5. Let $B = \{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3, \mathbf{v}_4\}$ be a basis for a vector space V and $T : V \to V$ the linear operator for which

$$T(\mathbf{v}_1) = \mathbf{v}_1 + \mathbf{v}_2 + \mathbf{v}_3 + 3\mathbf{v}_4$$
$$T(\mathbf{v}_2) = \mathbf{v}_1 - \mathbf{v}_2 + 2\mathbf{v}_3 + 2\mathbf{v}_4$$
$$T(\mathbf{v}_3) = 2\mathbf{v}_1 - 4\mathbf{v}_2 + 5\mathbf{v}_3 + 3\mathbf{v}_4$$
$$T(\mathbf{v}_4) = -2\mathbf{v}_1 + 6\mathbf{v}_2 - 6\mathbf{v}_3 - 2\mathbf{v}_4$$

   (a) Find the rank and nullity of T.

   (b) Determine whether T is one-to-one.

背面尚有試題

科目：工程數學
考試時間：100 分鐘

系所：
電機工程學系(通訊組)

是否使用計算機：是

本科原始成績：100 分

6. Let X be a random number from (0,1). Find the probability density function of $Y=1/X$.

7. Experience shows that X, the number of customers entering a postoffice, during any period of length t, is a random variable whose probability function is of the form

$$p(i) = k\frac{(2t)^i}{i!}, \quad i = 0,1,2,\cdots$$

(a) Determine the value of k.
(b) Compute $P(X < 4)$ and $P(X > 1)$.

8. The joint probability density function of random variables X and Y is given by

$$f(x,y) = \begin{cases} \lambda xy^2 & 0 \le x \le y \le 1 \\ 0 & \text{otherwise.} \end{cases}$$

(a) Determine the value of λ.
(b) Find the marginal probability density functions of X and Y.

9. Let the random variables W and Z be defined by

$W = \min(X, Y)$ and $Z = \max(X, Y)$.

Find the joint cdf of W and Z in terms of the joint cdf of X and Y.

10. Suppose U and V are independent zero-mean, unit-variance Gaussian random variables, and let

$X = U + V \qquad Y = 2U + V$

Find the joint characteristic function of X and Y, and find $E[XY]$.

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：通訊系統
考試時間：100 分鐘

系所：
電機工程學系(通訊組)
本科原始成績：100 分

是否使用計算機：是

1. (12%) Briefly describe the following terminologies used in communication systems:
   (a) white noise
   (b) frequency modulation (FM)
   (c) time-division multiplexing (TDM).

2. (10%) A wireless channel of bandwidth 2 MHz is perturbed by additive white Gaussian noise. According to Shannon's information capacity theorem, find the minimum signal-to-noise power ratio (SNR) required to support information transmission through the channel at a data rate of 10^7 bits per second (bps).

3. (16%) Fig. 1 shows the spectrum $M(f)$ of a band-limited message $m(t)$, where $M(f)=0$ for $|f|$ > 10 kHz. The message $m(t)$ is amplitude modulated (AM) with a carrier $c(t)=\cos(2\pi f_c t)$ of frequency f_c = 1 MHz.
   (a) Briefly draw the circuit of an AM modulator. For example, you may use $\oplus$ to represent an adder, and use $\otimes$ to represent a multiplier.
   (b) Plot the spectrum of the modulated signal.

4. (10%) Fig.1 shows the spectrum $M(f)$ of a band-limited message $m(t)$, where $M(f)=0$ for $|f|$ > 10 kHz. The message $m(t)$ is sampled instantaneously by an impulse train $p(t)=\sum_{n=-\infty}^{\infty}\delta(t-nT_s)$. If the sampled signal is to be recovered by an ideal reconstruction filter, what is the criterion of the sampling period T_s to avoid aliasing?

5. (12%) Draw the modulated waveforms of the binary sequence 10101101 by using the following pulse-code modulated (PCM) waveforms
   (a) unipolar nonreturn-to-zero (NRZ)
   (b) alternate mark inversion (AMI)
   (c) Manchester code

科目：通訊系統
考試時間：100 分鐘

系所：
電機工程學系(通訊組)
本科原始成績：100 分

是否使用計算機：是

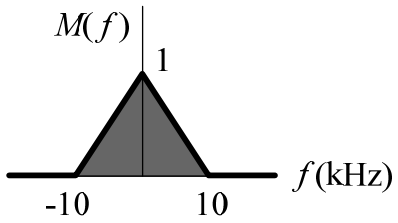


Fig. 1

科目：通訊系統
考試時間：100 分鐘

系所：
電機工程學系(通訊組)
本科原始成績：100 分

是否使用計算機：是

6. (24%) Fig. 2(a) shows a pair of pulses $s_1(t)$ and $s_2(t)$.
   (a) Show that $s_1(t)$ and $s_2(t)$ are orthogonal to each other over the time interval [0, T].
   (b) Determine the matched filters for the pulses $s_1(t)$ and $s_2(t)$ considered individually.
   (c) Form a two-dimensional matched filter by connecting the two matched filters of Part (b) in parallel, as shown in Fig. 2(b). When the pulse $s_2(t)$ is applied to the two-dimensional matched filter, find the output signals $y_1(t)$ and $y_2(t)$.

7. (16%) Consider a binary phase-shift keying (BPSK) system, the pair of signals $s_1(t)$ and $s_2(t)$ used to represent binary bits 1 and 0, respectively, is defined by

$$s_1(t) = +A\cos(2\pi f_b t) \quad \text{and} \quad s_2(t) = -A\cos(2\pi f_b t)$$

   where $0 \leqq t \leqq T_b$, $f_b = 1/T_b$, and T_b is the bit duration. The signal amplitude A = 10 mV and bit rate $R_b = 10^6$ bits per second (bps) are used.
   (a) Find the bit duration T_b and transmitted signal energy per bit E_b.
   (b) The signal is transmitted through a channel perturbed by additive white Gaussian noise of zero mean and single-sided power spectral density $N_0 = 10^{-11}$ W/Hz, and is received by the coherent BPSK demodulator. Suppose that $s_1(t)$ and $s_2(t)$ are transmitted with an equal probability, find the bit error probability P_b with the aid of Fig. 3.

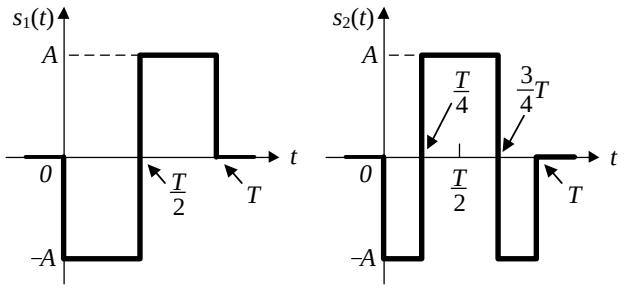


Fig. 2(a)

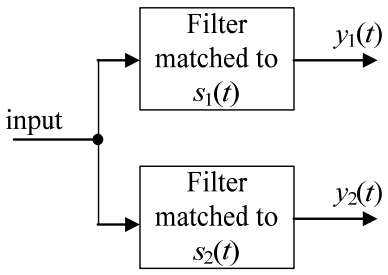


Fig. 2(b)

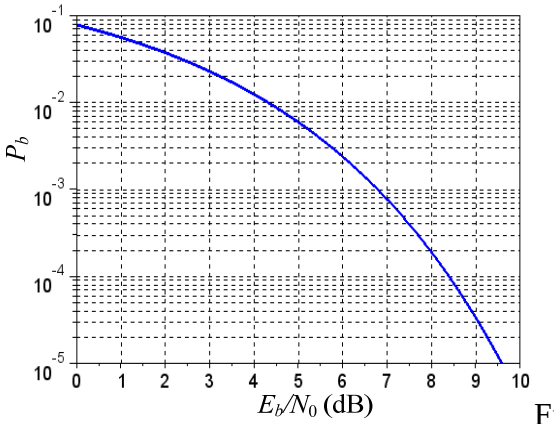


Fig. 3 P_b versus E_b/N_0 for a coherent BPSK system.

Reference Data
log 2 = 0.3010
log 3 = 0.4771
log 5 = 0.6990
log 7 = 0.8451

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：工程數學
考試時間：100 分鐘

系所：
電機工程學系(微電子組)　　是否使用計算機：是
本科原始成績：100 分

1. (10%) $y_{p1}=6e^{2x}$ and $y_{p2}=x^2+3x$ are the particular solutions for the linear differential equations (D.E.) $a_2(x)y''+a_1(x)y'+a_0(x)y=3e^{2x}$ and $a_2(x)y''+a_1(x)y'+a_0(x)y=5x^2+3x-8$, respectively.
(a) What is the particular solution for the linear D.E. (5%)
$a_2(x)y''+a_1(x)y'+a_0(x)y=3e^{2x}+5x^2+3x-8$
(b) What is the particular solution for the linear D.E. (5%)
$a_2(x)y''+a_1(x)y'+a_0(x)y=9e^{2x}-10x^2-6x+16$

2. (20%) Solve the given initial value problem
(a) $(x^3+y^3)dx+3xy^2dy=0,\ y(2)=1$ (10%)
(b) $x\dfrac{dy}{dx}-3y=x^5e^x,\ y(1)=5$ (10%)

3. (10%) $y'+y=f(t), y(0)=0, \text{where } f(t)=\begin{cases}0, & 0\le t<1\\ 2, & t\ge 1\end{cases}$

4. (10%) Solve the given system,
$\dfrac{dx}{dt}=x+y,$
$\dfrac{dy}{dt}=2x$
$x(0)=3, y(0)=0$

5. (10%) (a)Show the two matrices $A=\begin{bmatrix}2 & 3\\ -1 & 1\end{bmatrix}$ and $A=\begin{bmatrix}2 & 2\\ 3 & -7\end{bmatrix}$ are orthogonal. (5%)
(b)Determine if the vectors $v_1=(2,-2,4)$ $v_2=(3,-5,4)$ $v_3=(0,1,1)$ are linearly independent or linearly dependent (5%)

6. (10%) Find eigenvalues and eigenvectors of $A=\begin{bmatrix}1 & 1 & -1\\ 0 & 2 & 0\\ 0 & 1 & -1\end{bmatrix}$

背面尚有試題

科目：工程數學
考試時間：100 分鐘

系所：
電機工程學系(微電子組)
本科原始成績：100 分

是否使用計算機：是

7. (10%) Compute A^{-2} for the matrix, $A=\begin{bmatrix}-4 & -2\\ 5 & 5\end{bmatrix}$

8. (10%) Solve $X'=\begin{bmatrix}6 & -1\\ 5 & 2\end{bmatrix}X$

9. (10%) $A=\begin{bmatrix}0 & 1 & 1\\ 1 & 0 & 1\\ 1 & 1 & 0\end{bmatrix}$, find diagonal matrix D and the corresponding P^{-1} and P such that $D=P^{-1}AP$

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：微電子學
考試時間：100 分鐘

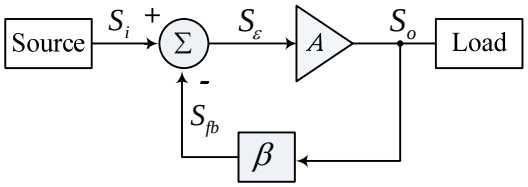
系所：
電機工程學系(微電子組)
本科原始成績：100 分

是否使用計算機：是

注意：小訊號分析時未將電晶體小訊號模型於解答中呈現者，將不予計分。

1. (a) Analyze and obtain the *transfer function* and *gain sensitivity* of the ideal feedback system in Fig.1(a). (4%+6%)
   (b) For ideal operational amplifier, describe the *concept of virtual ground*. (4%)
   (c). Fig.1(b) is the ideal shunt-series feedback topology, analyze and determine circuit characterizations including *closed-loop gain*, *input resistance* and *output resistance*. (10%)
   (d). Describe what is meant by *Nyquist stability criterion* for a feedback amplifier. (4%)

Fig.1(a)



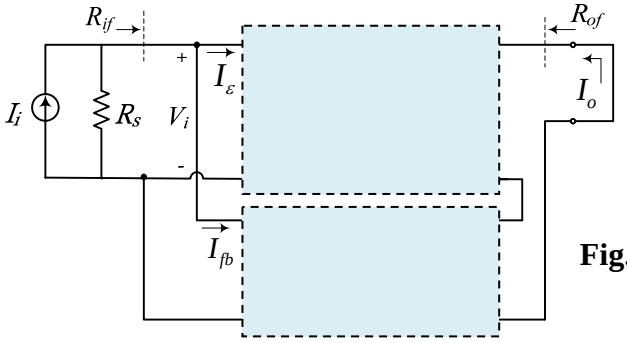
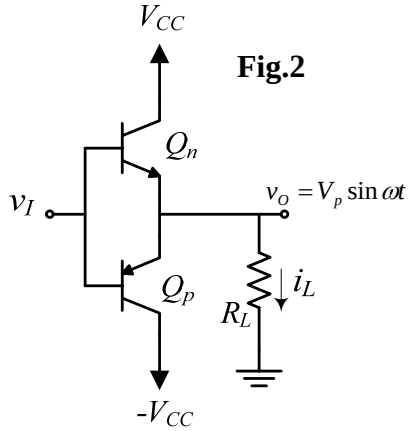


Fig.1(b)

2. (a) Describe what is meant by (a)*power conversion efficiency* and (b)*crossover distortion* for power amplifier. (2%+2%)
   (b). Fig.2 is a complementary push-pull output stage. If the base-emitter turn-on voltages are zero, describe and determine *the conversion efficiency*. And, when V_p=V_{CC}, the *maximum possible conversion efficiency*. (12%)

3. Fig.3 is the MOSFET cascode current mirror. Assume $I_{REF} = I_0$ and $\lambda \neq 0$. Determine the output resistance at the drain of M4. (5%)

Fig.2



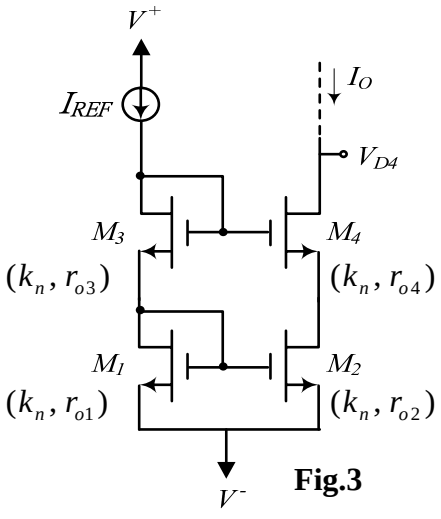


Fig.3

科目：微電子學
考試時間：100 分鐘

系所：
電機工程學系(微電子組)
本科原始成績：100 分

是否使用計算機：是

4. Fig.4 is a basic MOSFET differential pair configuration. Assume the transistors are matched, with $\lambda = 0$ for each transistor and that the constant-current source is represented by a finite output resistance R_0 for small-signal analysis. ($g_{m1} = g_{m2} = g_m, k_{M1} = k_{M2} = k_n$)

(a) Determine *differential-mode gain*, *common-mode gain* and *common-mode rejection ratio*. (12%)

(b) If $V^+ = 3V, V^- = -3V, I_Q = 0.2mA, R_D = 15k\Omega, V_{TN} = 0.4V$, and $k_n' = \frac{1}{2}\mu_n C_{ox} = 100\,\mu A/V^2$. Determine the *width-to-length ratio* of the transistors such that the one-sided differential voltage gain is $A_d = 15$. (4%)

5. (a) Describe *Early voltage effect* (Base-width modulation effect) by the steady-state minority carrier concentrations for a *npn* transistor biased in the active mode. (3%)

(b) In Fig.5(a), assuming uniform doping in each region, determine the *build-in potential barrier* in terms of N_A and N_D. (5%)

(c). In Fig.5(b), *pn* junction is biased in V_{bias}, assuming uniform doping in each region and $N_A > N_D$, determine *junction built-in voltage* (V_j) in terms of N_A and N_D. (8%)

6. (a).Plot the *inverting operational amplifier* and *non-inverting operational amplifier*, determine *voltage gain*, *input impedance* and *output impedance* when operational amplifier is ideal. (6%+6%)

(b). Determine the *voltage gain* $\frac{v_0}{v_I}$ in Fig.6. (3%)

(c). Using the result of part (b), at what frequency is the magnitude of the gain a factor of $\sqrt{2}$ less than the high-frequency limiting value? (4%)

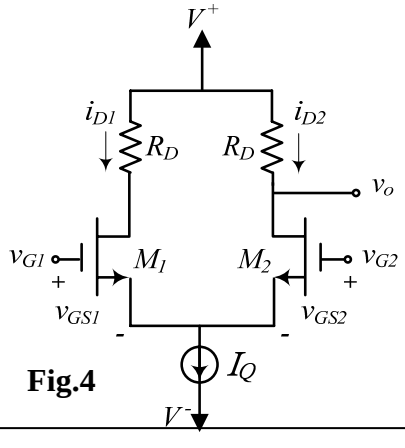


Fig.4

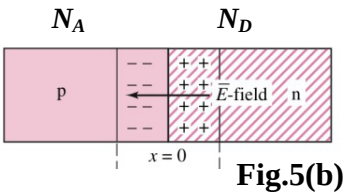


Fig.5(b)

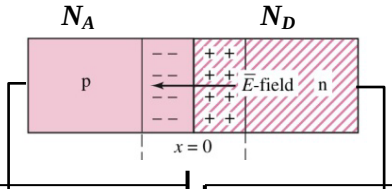


Fig.5(b)

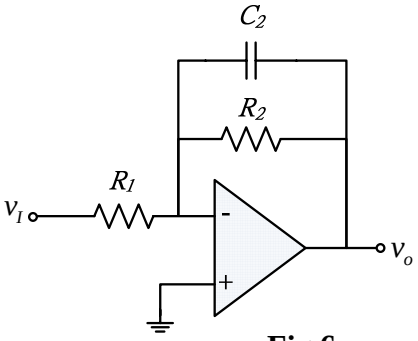


Fig.6

V_{bias} 背面尚有試題

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：微電子學
考試時間：100 分鐘

系所：
電機工程學系(微電子組)
本科原始成績：100 分

是否使用計算機：是

背面尚有試題

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：計算機結構
考試時間：100 分鐘

系所：
電機工程學系(計算機組)　　是否使用計算機：是
本科原始成績：100 分

1. Name three mechanisms by which a CMOS microprocessor consumes power. (15%)

2. It was known that microprocessors are single CPUs used in microcomputers. How do microcontrollers differ from microprocessor? Please address your issues from the following three perspectives: (a) hardware architecture, (b) applications, and (c) instruction set features. (10%)

3. How to perform the following computation through pipeline processing? Also please address the differences through non-pipeline processing. (10%)
   X(I+1) = X(I) + Y(I)*Z(I), I = 1,2,….,N

4. What is the average memory access time of a machine whose hit rate is 90%, with a cache access time of 3ns and a main memory access time of 70ns? (10%)

5. When would you prefer to use busy-wait I/O over interrupt-driver I/O ? (10%)

6. What is the difference between the Harvard and the Von Neumann architectures? (10%)

7. Why do most computer systems use memory-mapped I/O? (10%)

8. 計算機結構的記憶體切割(memory partition)設計，在以電腦系統執行視訊壓縮或影像資料處理的過程中，時常需要將影像資料存放在切割好的記體(partitioned memory)當中，以實現更有效的運作。

如圖一所示，我們說明了在二維影像平面中，I(X,Y)，的一張影像圖(2D image)，如何被儲存在計算機結構內，三個以一維定址的記憶體(1D memory)Mem0, Mem1 及 Mem2 內。其間每一像素的座標(x,y)必須被轉換到記憶體的正確一維陣列位址，Mem0(a) 、Mem1 (b)或 Mem2 (c)上。

首先令該影像圖是以列為主(Row Major Order)的二維陣列，圖上面任一點像素落在影像平面 X,Y 上，其座標表示為(x,y)，該像素的灰階值(Grey level or Intensity value)則表示為 f(x,y)。其中，x=0,1,2,.., M-1，y=0,1,2,.., N-1。影像平面 X,Y 上每個像素的灰階值 f(x,y)放置到其中一個一維定址的記憶體上，則表示為 Mem0(a), Mem1(b)及 Mem2(c)，其中，a, b 以及 c 就是記憶體的一維陣列位址值，且 a =0,1,2,…(,MN/3) -1, b =0,1,2,…(,MN/3) -1, c =0,1,2,…(,MN/3) -1。

也就是說，經過正確的轉換，f(x,y)所代表的值即是 Mem0(a)、Mem1(b)或 Mem2(c)內所存放的值。因此，我們進行計算機結構的記憶體切割(memory partition)設計，可推導獲得，將 f(x,y)的座標值轉換為 Mem0(a)、Mem1(b)或 Mem2(c)的位址值，其公式為：

a={(x/3)N+y | x, (x%3)=0}

國立高雄大學 101 學年度研究所碩士班招生考試試題

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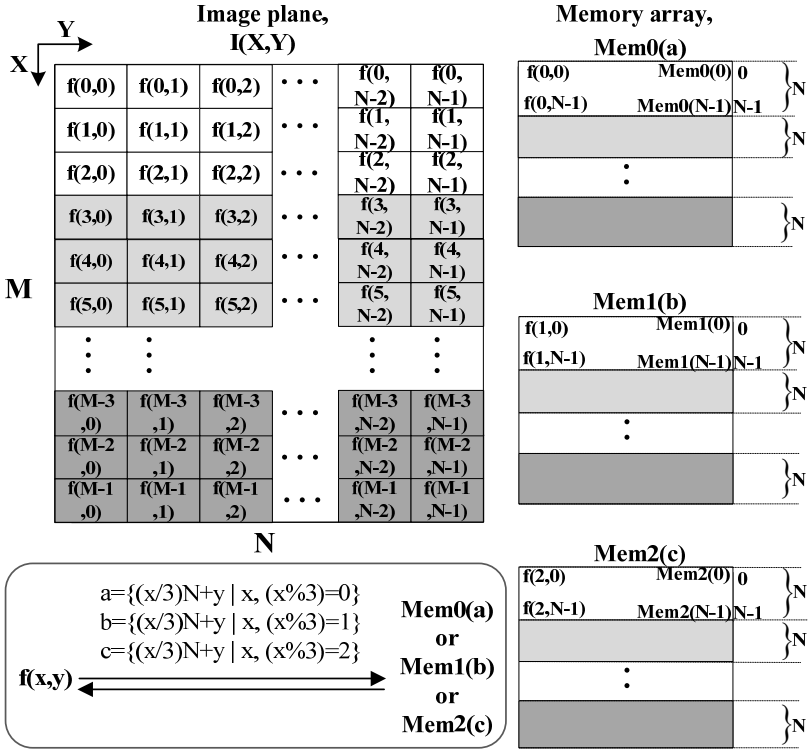
b={(x/3)N+y | x, (x%3)=1}

c={(x/3)N+y | x, (x%3)=2}

其中，運算元"%" 代表除取餘數，運算元"/" 代表除取商。



圖一　二維影像圖中每一像素點的灰階值存放於計算機結構內記憶體之一維位址的關係對應圖

試問：

(1)二維影像平面上的像素點 f(7,15)以及 f(M-1,N-5)經過計算機結構的記憶體切割(memory partition)設計後，分別會對應到那一塊記憶體的第幾個位址？(10%)

(2)在上述題意中，我們已經提供將 f(x,y)的座標值轉換為 Mem0(a)、Mem1(b)或 Mem2(c)之位址值的公式。在此，請您反向推導出將 Mem0(a)、Mem1(b)與 Mem2(c)位址值轉換為 f(x,y)之公式。並利用此結果驗證上述(1)當中所算出的答案。(15%)