國立雲林科技大學 104 學年度 碩士班招生考試試題	系所：電子系 科目：工程數學(3)

1. (15%)Please find the solution y=y(x).
   (a) $x(y^2+3)dx+3y(x^2+2)dy=0$
   (b) $y'=y\tan x$
   (c) $y''+y'+0.25y=0$

2. (10%)Given the equation $y''-y'-6y=8\cos 2x+6e^{4x}$ find the general solution.

3. (15%)An ODEs $y'=\dfrac{y}{2x}+\dfrac{x^2}{2y}$

   (a) Verify the ODE is not exact?
   (b) Find the integrating factor I(x,y).
   (c) Find the solution of the ODE.

4. (10%)Laplace equation:
   (a) If $f(t)=(t^2+\frac{1}{2})^2$, Find $L[f(t)]$
   (b) If $F(S)=\dfrac{1}{(S+2)(S+3)}$, Find $L^{-1}[F(S)]$

5. (10%)Use Gauss-Jordan elimination to solve the equation of system as following:

$$x_1+3x_2-2x_3=-7$$
$$4x_1+x_2+3x_3=5$$
$$2x_1-5x_2+7x_3=19$$

6. (15%)Find the eigenvalues and eigenvectors of the given matrix A.

$$A=\begin{pmatrix}5 & -1 & 0\\ 0 & -5 & 9\\ 5 & -1 & 0\end{pmatrix}$$

7. (10%)Evaluate $\oint_C (x^5+3y)dx+(2x-e^y)\,dy$, where C is the circle.

   $(x-1)^2+(y-5)^2=4$.

8. (15%)Find the flux of F(x,y,z)=zj+zk through the surface S given by that portion of the plane z=6-3x-2y in the first octant oriented upward.

國立雲林科技大學 104 學年度 碩士班招生考試試題

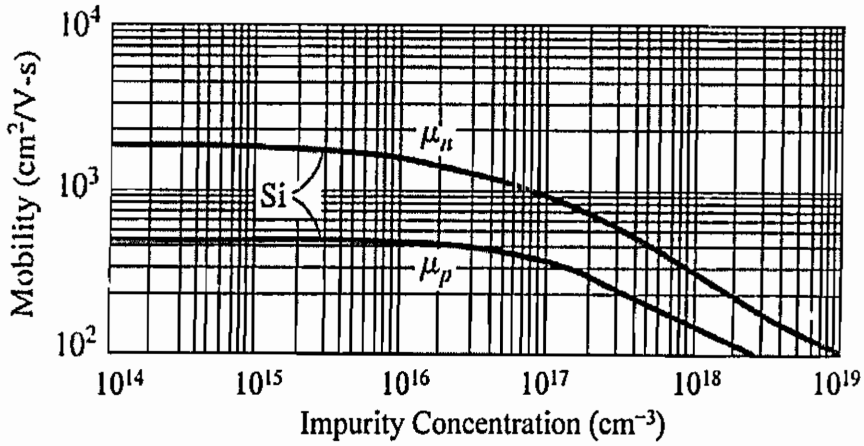
系所：電子系
科目：半導體元件

1. Explain or define the following terms:
   (a) Donor impurities in a semiconductor (5%)
   (b) Energy band gap of a semiconductor (5%)
   (c) Fermi-Dirac distribution of electrons in a semiconductor (5%)
   (d) Hole mobility (5%)

2. Describe the differences in energy band gap among the metal, semiconductor, and insulator. (15%)

3. Describe briefly the formation of the junction barrier in a p-n junction diode. (15%)

4. Consider a silicon semiconductor at T = 300K in which $N_a = 2\times10^{17}$ cm^{-3} and $N_d = 3\times10^{17}$ cm^{-3}. Find the electron, hole concentrations and the resistivity of this Si semiconductor by using figure as follow. ($n_i=10^{10}$cm^{-3}, $e=1.6\times10^{-19}$ C). (20%)



5. If an electron is stayed at a quantum well with width of 1.2 nm and with infinitely hard walls, find the ground state E_1 and first excited states E_2. ($m_e=9.1\times10^{-31}$kg, $h=6.626\times10^{-34}$ J-s) (15%)

6. Calculate the atomic surface density of crystal GaAs (110) with lattice constant of 5.65Å (15%)

國立雲林科技大學 104 學年度 碩士班招生考試試題

系所：電子系

科目：物理學

1. Consider Fig. 1. Box A, of mass 10 kg, rests on a surface inclined at 37° to the horizontal. It is connected by a lightweight cord, which passes over a massless and frictionless pulley, to a second box B, which hangs freely as shown. If the coefficient of kinetic friction is 0.3, and $m_B = 10$ kg, determine the acceleration of the system. ($\sin 37° = 0.6018$, $\cos 37° = 0.7986$) (8%)

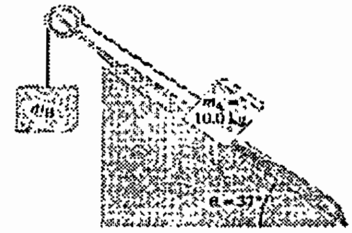


Fig. 1

2. Consider Fig. 2. A basketball is shot from an initial height of 2.4 m with an initial speed $v_0 = 12$ m/s directed at an angle $\theta_0 = 35°$ above the horizontal. (a) How far from the basket was the player if he made basket? (b) At what angle to the horizontal did the ball enter the basket? ($\sin 35° = 0.5736$, $\cos 35° = 0.8191$) (10%)

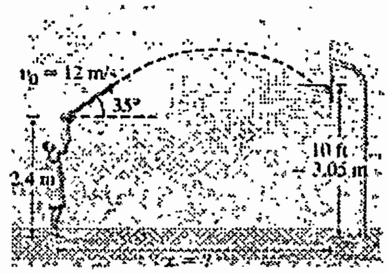


Fig. 2

3. A uniform stick 1.0 m long with a total mass of 270 g is pivoted at its center. A 3g bullet is shot through the stick midway between the pivot and one end. The bullet approaches at 250 m/s and leaves at 140 m/s. With what angular speed is the stick spinning after the collision? (6%)

4. Consider Fig. 3. Two identical, uniform beams are symmetrically set up against each other on a floor with which they have a coefficient of friction $\mu_s = 0.5$. What is the minimum angle the beams can make with the floor and still not fall? (8%)

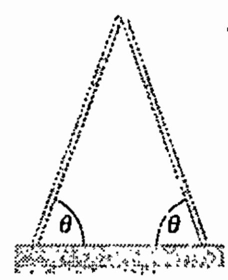


Fig. 3

5. Consider Fig. 4. A block of mass $m = 2.2$ kg slides down a 30.0° incline which is 3.6 m high. At the bottom, it strikes a block of mass $M = 7$ kg which is at rest on a horizontal surface. (Assume a smooth transition at the bottom of the incline.) If the collision is elastic, and friction can be ignored, determine (*a*) the speeds of the two blocks after the collision, and (*b*) how far back up the incline the smaller mass will go. (12%)

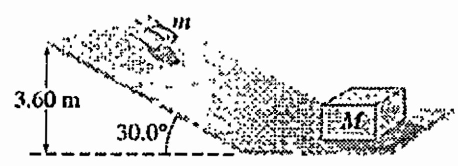


Fig. 4

6. Consider Fig. 5. A skier of mass m starts from rest at the top of a solid sphere of radius r and slides down its frictionless surface. At what angle will the skier leave the sphere? (6%)

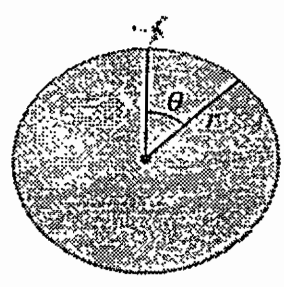


Fig. 5

國立雲林科技大學 104 學年度 碩士班招生考試試題

系所：電子系

科目：物理學

7. Consider the property of light.
   (a) What is the speed of light in vacuum? (5%)
   (b) What is the range of wavelength for visible light? (5%)

8. Consider Fig. 6. Two flat mirrors are placed perpendicular to each other. If a beam of light is incident on the first mirror with an angle of 30°, what is the angle θ for the outgoing beam? (10%)

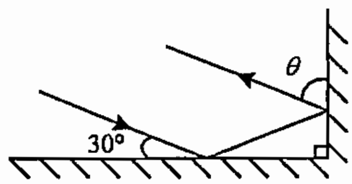


Fig. 6

9. Consider the total internal reflection.
   (a) Please explain the physical meaning of total internal reflection. (5%)
   (b) Assume a beam of light is incident from material 1 (refractive index $n_1 = 2.0$) to material 2 (refractive index $n_2 = 1.0$). What is the critical angle for total internal reflection to occur? (5%)

10. A 5-cm-high object is placed 30 cm in front of a converging lens, which has a +15 cm focal length.
    (a) What is the position of the image? (5%)
    (b) What is the size of the image? (5%)

11. Figure 7 shows a schematic diagram of the Young's double-slit experiment. Assume the distance between the slits is $d = 0.1$ mm, the distance to the screen is $L = 2$ m, and the wavelength of light is $\lambda = 500$ nm。
    (a) What is the approximate spacing between the adjacent bright interference fringes on the screen? (5%)
    (b) How many bright fringes can be seen on the screen if the screen is infinitely wide? (5%)

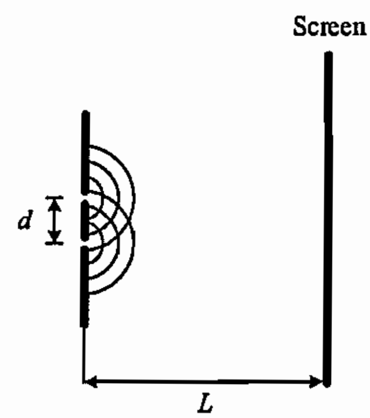


Fig. 7

國立雲林科技大學 104 學年度 碩士班招生考試試題

系所：電子系

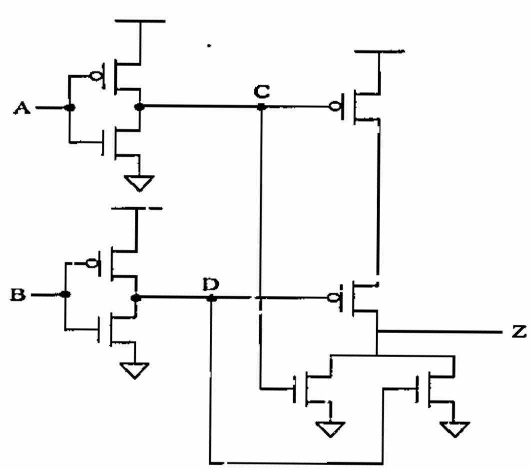
科目：計算機組織

1. (20 pts) Convert the following 2's complement binary numbers to decimal.
   (a) (4pts) 1010
   (b) (4pts) 0110
   (c) (4pts) 01011010
   (d) (4pts) 11111110
   (e) (4pts) 0011100111010011

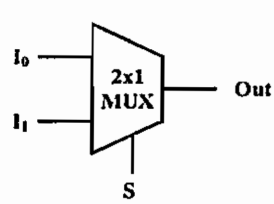
2. (10pts) Implement the XOR function by means of :
   (a) (5pts) NAND gates only.
   (b) (5pts) NOR gates only.
   Please draw the gate-level circuit.

3. (10pts) For the transistor-level circuit shown below:
   (a) (5pts) Fill in the truth table.
   (b) (5pts) What is Z in terms of A and B?

A	B	C	D	Z



4. (10 pts) A symbol of 2-to-1 mux is listed below. Please draw the gate-level circuit of 2-to-1 mux.



國立雲林科技大學 104 學年度 碩士班招生考試試題	系所：電子系 科目：計算機組織

5. (10 pts) What are the five addressing modes in MIPS? Give an example instruction for each mode.

6. (5pts) Describe how the memory address register (MAR) and memory address register (MDR) are used when reading data from the memory, and when writing data to the memory.

7. (5 pts) Translate the following machine code into MIPS code – be sure to include the correct register names, addresses, immediate values, etc. represented in the order they would appear in the MIPS instruction. Mark the boundaries between the instruction's fields.
1010 1101 1010 1001 0000 0000 0011 0010

8. (10 pts) Suppose that \$t0 holds the base address of an array of integers,
(a) (4 pts) Give MIPS code that loads the value of A[5] into register \$t2. (Hint: You can do this in one instruction.)
(b) (6 pts) Suppose that \$t0 holds the base address of an array of integers, A, and \$t1 holds the current value of an integer, n. Give MIPS code that loads the value of A[n] into register \$t2.

9. (10 pts) Consider a direct-mapped cache with 128 blocks. The block size is 32 bytes.
(a) (3 pts) Find the number of tag bits, index bits, and offset bits in a 32-bit address.
(b) (3 pts) Find the number of bits required to store all the valid and tag bits in the cache.
(c) (4 pts) Given the following sequence of address references in decimal:
20000, 20004, 20008, 20016, 24108, 24112, 24116, 24120
Starting with an empty cache, show the index and tag for each address and indicate whether a hit or a miss.

Address=Hex	Offset	Index	Tag	Hit or Miss
20000=0x4E20				
20004=0x4E24				
20008=0x4E28				
20016=0x4E30				
24108=0x5E2C				
24112=0x5E30				
24116=0x5E34				
24120=0x5E38				

10. (10 pts) Describe the procedure calling conventions for MIPS-32:

(a) (3 pts) How are arguments passed?

(b) (2 pts) How are results returned?

(c) (4 pts)Which of the user registers (ignoring $at, $k0 and $k1) have to be saved by the caller? (Assuming the caller needs them preserved.) Which ones are always saved by the callee?

(d) (1 pts) Where are local variables stored?

國立雲林科技大學 104 學年度 碩士班招生考試試題　　系所：電子系　科目：電子學

本試題共九題，每題得分如各題中所示，共計 100 分，請依題號作答並將答案寫在答案卷上，違者不予計分。

1. (10 分) Find the average power absorbed by the 10-Ω resistor in Fig. P1.

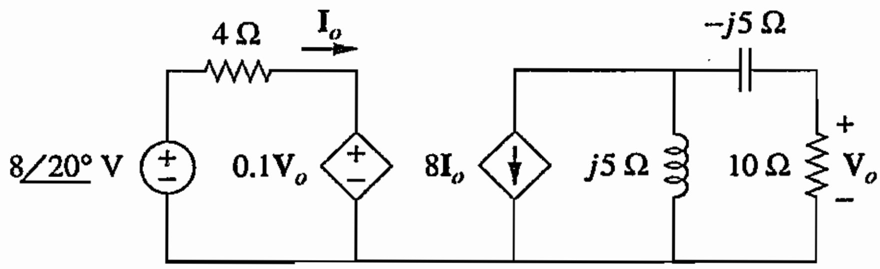


Fig. P1.

2. (10 分) Find the resonant frequency of the circuit in Fig. P2.

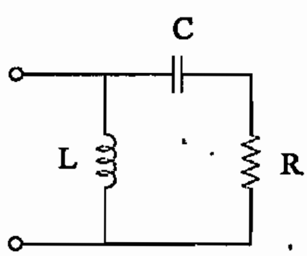


Fig. P2.

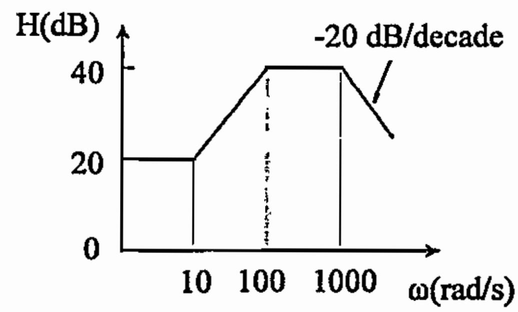


Fig. P3.

3. (10 分) Find the transfer function **H**(ω) with the magnitude plot shown in Fig. P3.

4. A system has the transfer function,

$$H(s) = \frac{s}{(s+1)(s+2)}$$

(1) (10 分) Find the impulse response of the system.

(2) (10 分) Determine the output $y(t)$ given that the input is $x(t) = u(t)$.

5. (8 分) Sketch four basic feedback topologies.

國立雲林科技大學 104 學年度 碩士班招生考試試題 系所：電子系 科目：電子學

6. Fig. P6 shows output stage amplifier. Assume the threshold voltages of all devices to be equal in magnitude. The k denotes $1/2(\mu C_{ox} W/L)$.
   (1) (4 分) Find the relationship between I_3 and I_1 in terms of k_1, k_2, k_3, and k_4 of the four transistors.
   (2) (4 分) Find the required value of I_1 to yield a bias current in M_3 and M_4 of 1.6mA in the event that $k_1 = k_2$ and $k_3 = k_4 = 16k_1$.

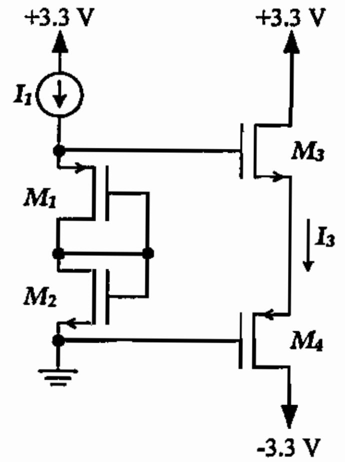


Fig. P6.

7. Sketch the CMOS logic circuits that realizes the function:
   (1) (2 分) $Y = A\overline{B} + \overline{A}B$.
   (2) (2 分). $Y = \overline{A(B + CD)}$

8. A design error has resulted in a gross mismatch in the circuit of Fig. P8. Specifically, M_2 has twice the W/L ratio of M_1. If v_{id} is a small sine-wave signal find:
   (1) (5 分) I_{D1} and I_{D2}.
   (2) (5 分) V_{OV} for each of M_1 and M_2
   (3) (5 分)The differential gain A_d in terms of R_D, I, and V_{OV}.

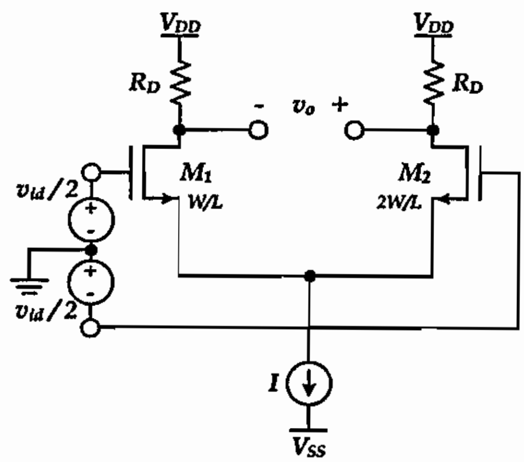


Fig. P8.

9. For the single-stage integrated-circuit amplifier,
   (1) (5 分) sketch a schematic of a simple MOS cascade amplifier.
   (2) (5 分) sketch a schematic of a simple BiMOS cascade amplifier.
   (3) (5 分) sketch a schematic of a simple CG configuration amplifier.

國立雲林科技大學 104 學年度 碩士班招生考試試題

系所：電子系
科目：電磁學

Useful physical constants: $\varepsilon_0 \approx \frac{10^{-9}}{36\pi}$ (F/m); $\mu_0 = 4\pi \times 10^{-7}$ (H/m)

Be aware of including the unit in the answer.

1. Suppose a propagating electric field is given by

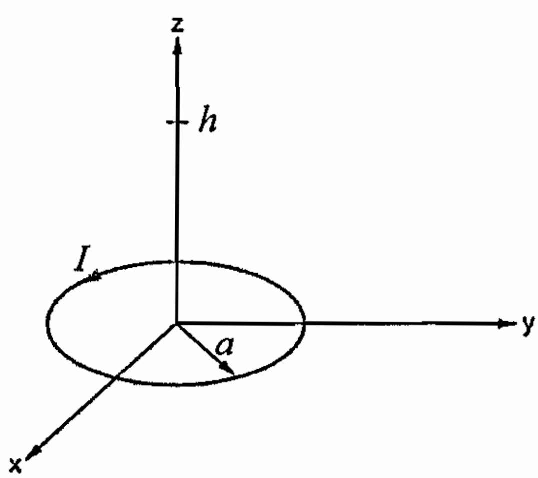
   $E(z, t) = 17e^{-0.001z}\cos(2\pi \times 10^9 t - 5\pi z + 45°)$ V/m. Find

   (a) the initial amplitude, (b) the attenuation constant, (c) the wave frequency, (d) the wavelength, and (e) the phase shift in radians. (10%)

2. An inhomogeneous dielectric fills a parallel-plate capacitor of surface area 50.0 cm^2 and thickness 1.0 cm. Given $\varepsilon_r = 3(1 + z)$, where z is measured from the bottom plate in centimeters. Determine the capacitance. (10%)

3. The potential field in a material with $\varepsilon_r = 10.0$ is $V = 10\,xy^2$ (V). Find **E**, **P**, and **D**. (10%)

4. Consider a ring of current with radius a lying in the x–y plane with a current I in the $+\mathbf{a}_\phi$ direction as shown in the figure. Find an expression for the magnetic field at a point (0, 0, h) on the z-axis. (20%)



國立雲林科技大學 104 學年度
碩士班招生考試試題
系所：電子系
科目：電磁學

5. Find the current density **J** at (2 m, 1 m, 3 m) for magnetic field $\mathbf{H} = 2xy^2\,\mathbf{a}_z$ A/m. (15%)

6. The magnetic field is given as $\mathbf{H}_1 = 6\mathbf{a}_x + 2\mathbf{a}_y + 3\mathbf{a}_z$ A/m in a medium with $\mu_{r1} = 6000$ that exists for $z < 0$. Find $\mathbf{H}_2$ in a medium with $\mu_{r2} = 3000$ for $z > 0$. (15%)

7. Fulfill the fundamental electromagnetics equations. (16%)

Maxwell's equations	Point(differential) form	Integral form
Gauss's law	(7A)	(7B)
Gauss's law for magnetic fields	(7C)	(7D)
Faraday's law	(7E)	(7F)
Ampere's circuital law	(7G)	(7H)

8. Sketch diagrams to explain the meanings of electrostatic and magnetostatic boundary conditions. (4%)

Electrostatic	**Magnetostatic**
$E_{T1} = E_{T2}$	$\mathbf{a}_{21}\times(\mathbf{H}_1-\mathbf{H}_2) = \mathbf{K}$
$\mathbf{a}_{21}\times(\mathbf{D}_1-\mathbf{D}_2) = \rho_s$	$B_{N1} = B_{N2}$