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　　系所：應用物理學系　　是否使用計算機：是
考試時間：100 分鐘　　本科原始成績：100 分

每題 10 分

1. $y(x)''+y(x)'^3\sin[y(x)]=0$ 請問$y(x)$?

2. $y(x)''+4y(x)'+5y(x)=0$ 初始條件 $y(0)=2, y(0)'=-5$

   求$y(x)$?

3. $y(t)+\int_0^t(t-\tau)y(\tau)d\tau=1$　求$y(t)$

4. $A=\begin{bmatrix}3 & -1 & 1\\ -15 & 6 & -5\\ 5 & -2 & 2\end{bmatrix}$求$A^{-1}$

5. 求$\begin{bmatrix}1 & 0 & 1\\ 0 & 3 & 2\\ 0 & 0 & 2\end{bmatrix}$eigenvalues 與 eigenvectors

6. 求平面積分$\iint_s(\nabla xF)\cdot ndA$,函數

   $F=[-e^y, e^x, e^x]$, 平面 $S: z=x+y\ (0\le x\le 1, 0\le y\le 1)$

7. 求週期函數$f(x)=|x|(-1<x<1)$的 Fourier 級數

8. 求複數積分$\oint_C \frac{dz}{z^2-1}, C: |z+1|=1$

9. 求積分$\int_0^{2\pi}\frac{d\theta}{37-12\cos\theta}$

科目：工程數學　　系所：應用物理學系　　是否使用計算機：是
考試時間：100 分鐘　　本科原始成績：100 分

10. 求積分 $\int_{-\infty}^{\infty} \frac{x+5}{x^3-x} dx$

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：電子學　　系所：應用物理學系　　是否使用計算機：是

考試時間：100 分鐘　　本科原始成績：100 分

1. The reverse-saturation current of a silicon pn junction diode at T = 300 K is $I_s = 10^{-12}$ A. Determine the temperature range over which I_s varies from 2×10^{-12} A to 60×10^{-12} A. (20%)
2. With the circuit in Fig. 1, let β=100. (a)Find R_{TH} and V_{TH} for the base circuit. (10%) (b) Determine I_{CQ}, V_{CEQ}. (10%)
3. If the emitter voltage (V_E) of the circuit shown in Fig. 2 is 1 V, assume that $|V_{BE}| = 0.7$V, what are V_B, I_B, I_E, I_C, V_C, β and α? (20%)
4. Determine the deviation from the ideal due to a finite differential gain. Consider an inverting op-amp with R_1=10kΩ and R_2=100kΩ in Fig. 3. Determine the closed-loop gain for: $A_{od}= 10^2$, 10^3, 10^4, 10^5 and 10^6. Calculate the percent deviation from the ideal gain. (20%)
5. Determine the corner frequencies and limiting horizontal asymptotes of a common-emitter circuit with an emitter bypass capacitor. Consider the circuit in Fig. 4 with parameters R_E=4KΩ, R_C= 2KΩ, R_s= 0.5KΩ, C_E= 1μF, V^+= 5V, and V^-= -5V. The transistor parameters are: β= 100, $V_{BE(on)}$= 0.7V, and r_o= ∞. (20%)

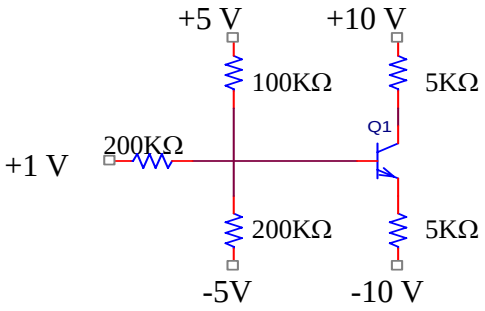

Fig. 1

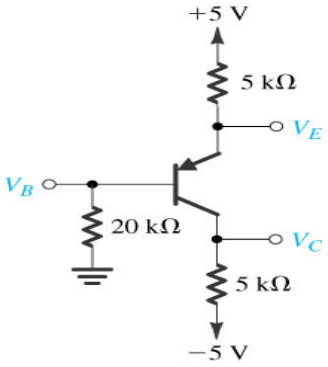

Fig. 2

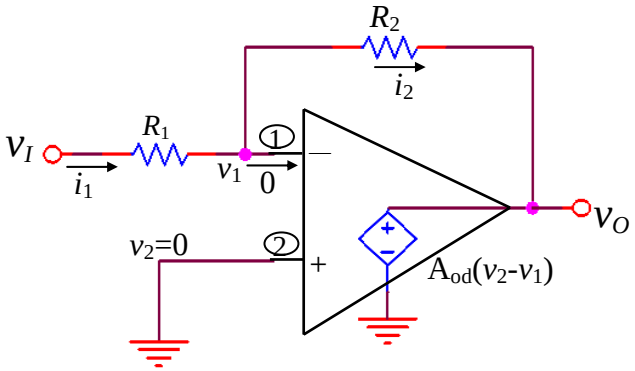

Fig. 3

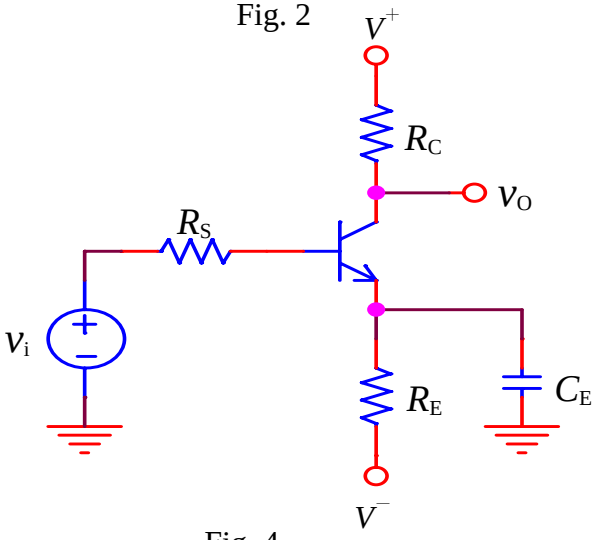

Fig. 4

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：電磁學　　系所：應用物理學系　　是否使用計算機：是

考試時間：100 分鐘　　本科原始成績：100 分

1. Write down the Maxwell's equations in matter and boundary conductions. (10%)

2. Two point charges, 3q and –q, are separated by a distance a, as shown in Fig. 1. Find (a) the monopole moment, (b) the dipole moment, and (c) the approximate potential at a large distance. (15%)

3. A constant potential V_0 is specified on the surface of a hollow sphere, of radius R. Find the potential inside and outside the sphere. (20%)

4. A uniformly magnetized sphere with $\vec{M} = M\hat{z}$, as shown in Fig. 2. Find the (a) bound volume current, (b) bound surface current, (c) magnetic field, $\vec{B}$, inside the sphere and (d) $\vec{H}$. (note that $\vec{H} \equiv \frac{\vec{B}}{\mu_0} - \vec{M}$) (20%)

5. A long coaxial cable carries current I (The current flows down the surface of the inner cylinder, radius a, and back along the outer cylinder, radius b. Two cylinders are held at potential difference V), Fig. 3. Calculate (a) the electric field and (b) the magnetic field between the cylinders. Find (c) the magnetic energy stored in and (d) the self-inductance of a section of length *l*. Calculate (e) the Poynting vector and (f) the power transported down the coaxial cable and (g) the electromagnetic momentum stored in the fields in a section of length *l*. (35%)

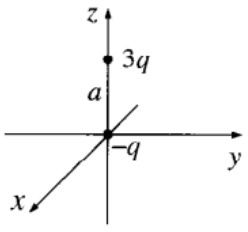

Fig. 1

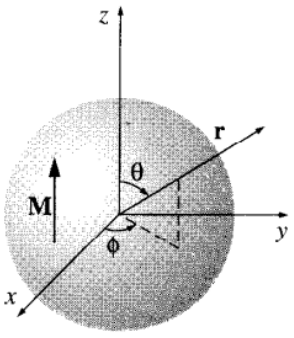

Fig. 2

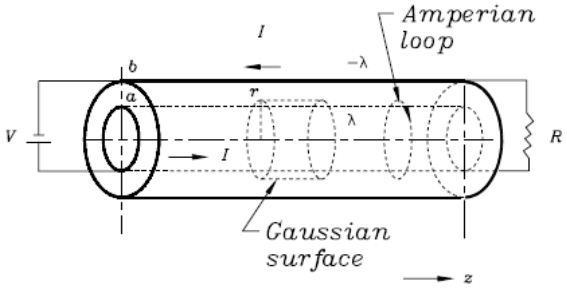

Fig. 3