一、單選題 (50%)

1. Given a vector field $\vec{E}(x,y,z)=\hat{x}E_x(x,y,z)$ which satisfies the rule $\vec{\nabla}\times\vec{E}=0$, what solution as followed is true? (A) $E_x=2x$ (B) $E_x=2x+y$ (C) $E_x=3y$ (D) $E_x=2z$ (10%)

2. Given a vector field $\vec{E}(r,\phi,z)=\hat{\phi}\,E_\phi(r)$ which satisfies the rule $\vec{\nabla}\times\vec{E}=0$, what solution as followed is true? (A) $E_\phi=r$ (B) $E_\phi=1/r$ (C) $E_\phi=1/r^2$ (D) $E_\phi=\ln r$ (10%)

3. Given a vector field $\vec{E}(r,\theta,\phi)=\hat{r}\,E_r(r)$ which satisfies the rule $\vec{\nabla}\cdot\vec{E}=0$, what solution as followed is true? (A) $E_r=r$ (B) $E_r=1/r$ (C) $E_r=1/r^2$ (D) $E_r=\ln r$ (10%)

4. Given a vector field $\vec{E}(r,\theta,\phi)=\hat{r}\,E_r(r)$ which satisfies the rule $\vec{\nabla}\cdot\vec{E}=C, C=\text{constant}$, what solution as followed is true? (A) $E_r=r$ (B) $E_r=1/r$ (C) $E_r=1/r^2$ (D) $E_r=\ln r$ (10%)

5. For an inductor circuit, $V_L(t)=L\dfrac{dI_L(t)}{dt}$, if a current impulse ($I_L(t=0^-)=0, I_L(t=0^+)=I_0$) passes through the inductor, what condition as followed is true? (A) $V_L(t=0)=0$ (B) $V_L(t=0)=\text{constant}$ (C) $V_L(t=0)=\infty$ (D) 以上皆非

二、計算題 (50%)

6. (10%) Find the inverse of the matrix

$$\mathbf{A}=\begin{bmatrix}1 & -1 & 0\\ 1 & 0 & -1\\ -6 & 2 & 3\end{bmatrix}$$

7. (10%) Find the determinants $|\mathbf{A}|$ and $|\mathbf{A}^{-1}|$ for the matrix

$$\mathbf{A}=\begin{bmatrix}2 & -1 & 0 & -2\\ -1 & 0 & 2 & 3\\ -1 & 1 & 0 & 2\\ -2 & 3 & 0 & 1\end{bmatrix}$$

8. (10%) Write the vector $\mathbf{w}$ = (3, 4, 6) as a linear combination of vectors in the set $\boldsymbol{S}$ = {$\mathbf{v}_1$ = (1, 2, 3), $\mathbf{v}_2$ = (0, 1, 2), $\mathbf{v}_3$ = (–2, 0, 1)}.

9. (10%) Find the exponential Fourier series for the periodic signal $x(t) = A\cos(2\pi f_0 t)$.

10. (10%) Find the Fourier transform of rect(t/T), where

$$\text{rect}(t)=\begin{cases}1 & |t|\le\frac{1}{2}\\ 0 & |t|>\frac{1}{2}\end{cases}$$