

中 華 大 學

104 學年度碩士班招生入學考試試題紙

系所別：電機工程學系碩士班 組別：通訊光電組、系統組、電子電路組、微電子暨晶片設計組
科目：工程數學【含線性代數、微分方程(含傅立葉及拉式轉換)】

可攜帶計算機，不可攜帶翻譯機或字典

1. (20%) For a matrix $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$, please find

(1) the eigenvalues and eigenvectors

(2) e^A

2. (30%) Solve the following ordinary differential equations:

(1) $y'' + 3y' + 2y = 4t$, $y(0) = y'(0) = 0$

(2) $y'' + 2y' + y = \sin t$, $y(0) = y'(0) = 0$

(3) $y'' + 4xy' + 2y = 4 \ln x$, $y(1) = y'(1) = 0$

3. (30%) Given the Laplace transform $L\{f(t)\} = \int_0^{\infty} f(t)e^{-st} dt = F(s)$, please derive

(1) $L\{\sin t\} = \int_0^{\infty} \sin t e^{-st} dt = \frac{1}{s^2 + 1}$

(2) $L\{t\} = \int_0^{\infty} t e^{-st} dt = \frac{1}{s^2}$

(3) $L\left\{\frac{df(t)}{dt}\right\} = \int_0^{\infty} \frac{df(t)}{dt} e^{-st} dt = sF(s) - f(0)$

4. (20%) Given the Fourier transform $F\{g(t)\} = \int_{-\infty}^{\infty} g(t)e^{-j\omega t} dt = G(\omega)$, please derive

(1) $F\{e^{-|t|}\} = \int_{-\infty}^{\infty} e^{-|t|} e^{-j\omega t} dt = \frac{2}{\omega^2 + 1}$

(2) $F\left\{\int_{-\infty}^t g(\tau) d\tau\right\} = \int_{-\infty}^{\infty} \int_{-\infty}^t g(\tau) d\tau e^{-j\omega t} dt = \frac{G(\omega)}{j\omega}$