

國立中央大學104學年度碩士班考試入學試題

所別：電機工程學系碩士班 系統與生醫組(一般生) 科目：信號與系統 共 1 頁 第 1 頁

本科考試禁用計算器

*請在答案卷(卡)內作答

參考用

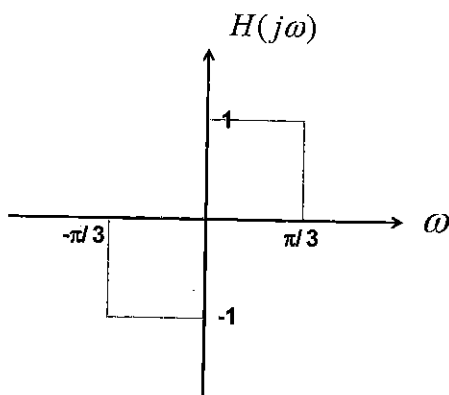
1. Consider a multi-path communication channel, the relation between received signal $y[n]$ and transmission signals $x[n]$ is $y[n]=x[n]+3x[n-1]+2x[n-2]$. Please answer the following question.

- (a) Please use z-transform to derive a casual system $H(z)$ to describe the multi-path communication channel. (7%)
- (b) Please find the z-transform of $H^{inv}(z)$ which is the inverse system of $H(z)$. (3%)
- (c) Please use inverse z-transform to find the impulse response $h^{inv}[n]$ for $H^{inv}(z)$. (10%)

2. Please prove the following Fourier transform properties:

- (a) $x[n] * y[n] \xrightarrow{F} X(e^{j\omega})Y(e^{j\omega})$, where $*$ is the convolution operator. (5%)
- (b) $E = \sum_{n=-\infty}^{\infty} |x[n]|^2 = \frac{1}{2\pi} \int_{-\pi}^{\pi} |X(e^{j\omega})|^2 d\omega$. (10%)

3. Consider the following continuous-time low-pass filter system $H(j\omega)$. Please answer the following question:



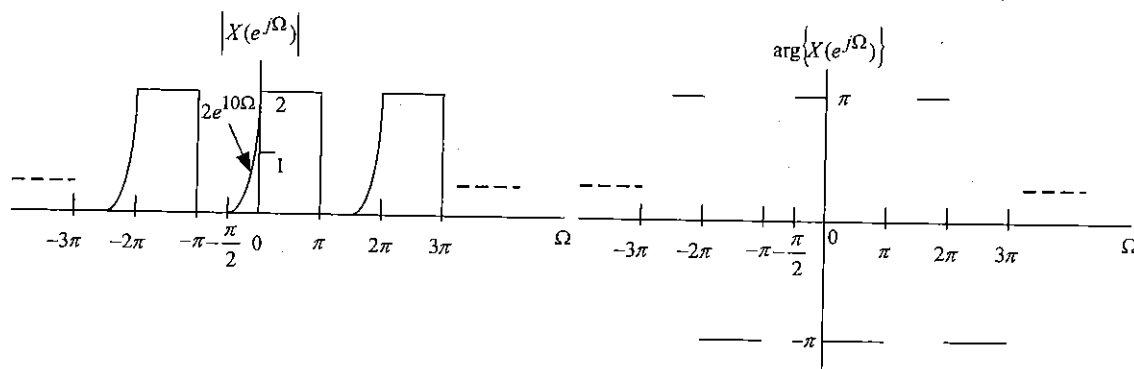
- (a) Please use continuous-time inverse Fourier transform to find the impulse response $h(t)$ of the system. (10%)
- (b) For an input signal $x(t) = 2 \cdot \cos(\frac{\pi t}{4}) + 4 \cdot \sin(\frac{\pi t}{6}) + 5 \cdot \sin(\frac{\pi t}{2})$, please find the output of this low-pass filter. (5%)

4. Find the frequency-domain representation for signal

$$x(t) = \left(\frac{d}{dt} \left\{ e^{-2t} u(3t) \right\} * \left(e^{-3t} u(t-1) \right) \right) \times e^{-j4t} \quad (15\%)$$

5. For a system $h(t)$, the input $x(t) = e^{-5t} u(t)$ and the output $y(t) = e^{-t} u(t) + e^{-3t} u(t)$. Determine the impulse response of its inverse system $h^{inv}(t)$. (10%)

6. Find the time-domain signal for the following frequency-domain representation. (15%)



7. Evaluate $\int_{-\infty}^{\infty} \frac{16}{(3+jt)^2} dt$. (10%)