100 QUESTIONS FOR MEDE2500 CHECK LIST

(1) $a + jb = re^{j\theta}$, express r, θ in terms of a and b
(2) $re^{j\theta} = a + jb$, express a, b in terms of r and θ
(3) For a signal $f(t) = A\sin(2\pi ft + \phi)$ what are the meaning of A, f and ϕ ?
(4) For a signal $f(t) = A\sin(2\pi ft + \phi)$, what is period of this signal?
(5) For a signal $f(t) = A\sin(2\pi ft + \phi)$, what is the energy of this signal ?
(6) For a signal $f(t) = A\sin(2\pi ft + \phi)$, what is the power of this signal ?
(7) For a signal $f(t) = A\sin(2\pi ft + \phi)$, what is RMS value of this signal ?
(8) What does "linear system" mean? Write down a linear system and a non-linear system.
(9) What does "BIBO stable" mean? Write down a stable system and a non-stable system
(10) What does "causal" mean? Write down a causal system and a non-causal system
(11) What does "time-invariant" mean? Write down a time-invariant system and a time-variant system
(12) What is Euler's Formula? Write it down
(13) What is Shannon-Nyquist Sampling Theorem? Write it down.
(14) For two signals $\cos(\omega_0 t)$ and $\cos(\omega_1 t)$, plot their spectrum by Euler's Formula. Plot the spectrum of $\cos(\omega_0 t)\cos(\omega_1 t)$, what is the effect of multiplication on the spectrum?
(15) For a signal $x(t) = \cos(2\pi f_1 t + \phi)$, find the sampling frequency, and find $x[n]$ by applying that sampling frequency
(16) What happen if sampling frequency does not satisfay the sampling theorem?
(17) What is the aliasing frequency if aliasing occur?
(18) What is the normalized frequency in the sampling process? Write it down
(19) For signal $f(t) = A\sin(2\pi ft + \phi)$, plot the spectrum
(20) For signal $f(t) = A\cos(2\pi ft + \phi)$, plot the spectrum
(21) For signal $f(t) = A\sin(2\pi f_1 t + \phi) + B\cos(2\pi f_2 t + \phi_2)$ is this signal periodic ? If yes, what is the period of this signal? Also what should be the sampling frequency?
(22) For signal $f(t) = A\sin(2\pi f_1 t + \phi) + B\cos(2\pi f_2 t + \phi_2)$, plot the spectrum
(23) For signal $f(t) = A\sin(2\pi f_1 t + \phi)\, B\cos(2\pi f_2 t + \phi_2)$ is this signal periodic ? If yes, what is the period of this signal? Also what should be the sampling frequency?
(24) For signal $f(t) = A\sin(2\pi f_1 t + \phi)\, B\cos(2\pi f_2 t + \phi_2)$, plot the spectrum
(25) For signal $f(t) = A\sin^2(2\pi f_1 t + \phi)$ is this signal periodic ? If yes, what is the period of this signal? Also what should be the sampling frequency?
(26) For signal $f(t) = A\sin^2(2\pi f_1 t + \phi)$, plot the spectrum
(27) For signal $f(t) = A\sin^n(2\pi f_1 t + \phi)$ is this signal periodic ? If yes, what is the period of this signal? Also what should be the sampling frequency?
(28) For signal $f(t) = A\sin^n(2\pi f_1 t + \phi)$, plot the spectrum
(29) What are even function and odd function? Write down their properties
(30) For signal $f(t)$, it can be expressed as sum of a even function $f_e(t)$ and a odd function $f_o(t)$. Write down $f_e(t)$ and $f_o(t)$ interms of $f(t)$.
(31) What is Real Fourier Series ? Write it down. Also write down the ways to find the coefficients.
(32) What happen to the Fourier coefficients if the signal under analysis is even? What about odd?
(33) What is Complex Fourier Series? Write it down. Also write down the way to find the coefficients.
(34) What is Fourier Transform ? Write it down.
(35) What is Z-transform ? Write it down.
(36) What is Discrete-Time Fourier Transform? Write it down.
(37) For periodic signal $x(t) = \begin{cases} A & 0 \le t \le \frac{T}{2} \\ 0 & \frac{T}{2} \le t \le T \end{cases}$, $x(t+nT) = x(t)$, plot it out, find the Fourier Series of this signal, plot the spectrum
(38) For periodic signal $x(t) = \begin{cases} A & 0 \le t \le \frac{T}{2} \\ -A & \frac{T}{2} \le t \le T \end{cases}$, $x(t+nT) = x(t)$, plot it out, find the Fourier Series of this signal, plot the spectrum

(39) For aperiodic signal $x(t) = \begin{cases} A & 0 \le t \le \frac{T}{2} \\ 0 & \text{else} \end{cases}$, plot it out, find the Fourier Transform of this signal, plot the spectrum

(40) For aperiodic signal $x(t) = \begin{cases} A & 0 \le t \le \frac{T}{2} \\ -A & \frac{T}{2} \le t \le T \\ 0 & \text{else} \end{cases}$, plot it out, find the Fourier Transform of this signal, plot the spectrum

(41) What is $\delta(t)$, $u(t)$ and $r(t)$? Write it out their expression. What are the relationships between them?

(42) What is $\delta[n]$, $u[n]$ and $r[n]$? Write it out their expression. What are the relationships between them?

(43) For $\delta(t)$, find its Fourier Transform. Plot the spectrum. What is the sampling frequency for this signal?

(44) For $u(t)$, find its Fourier Transform. Plot the spectrum. What is the sampling frequency for this signal?

(45) For $r(t)$, find its Fourier Transform. Plot the spectrum. What is the sampling frequency for this signal?

(46) Plot $u(t)$, $u(-t)$, $u(2t)$, $u(-2t)$, $u(0.5t)$, $u(-0.5t)$, $u(t-1)$, $u(-t-1)$, $u(t+1)$, $u(-t+1)$

(47) Plot $u(t)+u(-t)$, $u(t-a)-u(t-b)$, $u(t-a)+u(t-b)$, $u(a-t)-u(b-t)$, $u(t+a)-u(t+b)$

(48) Simplify the expressions: $\int_{-\infty}^{\infty} f(t)u(t)dt$, $\int_{-\infty}^{\infty} f(t)u(-t)dt$, $\int_{-\infty}^{\infty} f(t)u(t-a)dt$, $\int_{-\infty}^{\infty} f(t)u(t+a)dt$, $\int_{-\infty}^{\infty} f(t)u(-t+a)dt$, $\int_{-\infty}^{\infty} f(t)u(-t-a)dt$

(49) What is convolution in continuous time ? Write it down for signal $x(t)$ and $h(t)$

(50) What is convolution in discrete time ? Write it down for signal $x[n]$ and $h[n]$

(51) For continuous time system, what is impulse response ?

(52) For continuous time system, given the impulse response is $h(t)$, what is the output of the system if $u(t)$ is the input?

(53) For a continuous time system, the input $x_1(t)$ produces $y_1(t)$, find the output $y_2(t)$ if $x_2(t)$ is injected into the same system. Find $y_2(t)$ using convolution (time domain method)

(54) For a continuous time system, the input $x_1(t)$ produces $y_1(t)$, find the output $y_2(t)$ if $x_2(t)$ is injected into the same system. Find $y_2(t)$ using Fourier Transform (frequency domain method)

(55) For discrete time system, what is "impulse respose" ?

(56) For discrete time system, what does "finite impulse response" mean?

(57) For discrete time system, what does "infinite impulse response" mean?

(58) For discrete time system, given the impulse response of a system as$h[n]$, what is the output of the system if $u[t]$ is the input?

(59) For a discrete time system, the input $x_1[n]$ produce $y_1[n]$, find the output $y_2[n]$ if $x_2[n]$ is injected into the same system by both time domain method.

(60) For a discrete time system, the input $x_1[n]$ produce $y_1[n]$, find the output $y_2[n]$ if $x_2[n]$ is injected into the same system by z-domain method.

(61) What are the meaning of zeros and poles? How to determine the stability of a discrete system by the positions of zeros and poles?

(62) For discrete system equation $y[n] = a_0x[n] + a_1x[n-1] + a_2x[n-2]$, write down the transfer function

(63) For discrete system equation $y[n] = a_0x[n] + a_1x[n-1] + a_2x[n-2]$, what are the zeros and poles?

(64) For discrete system equation $y[n] = \sum_{i=1}^{N} a_i x[n]$, write down the transfer function

(65) For discrete system equation $y[n] = \sum_{i=1}^{N} a_i x[n-i]$, what are the zeros and poles?

(66) For discrete system equation $b_0y[n] + b_1y[n-1] + b_2y[n-2] = a_0x[n] + a_1x[n-1] + a_2x[n-2]$, write down the transfer function

(67) For discrete system equation $b_0y[n] + b_1y[n-1] + b_2y[n-2] = a_0x[n] + a_1x[n-1] + a_2x[n-2]$, what are the zeros and poles?

(68) For discrete system equation $\sum_{i=1}^{M} b_i y[n-i] = \sum_{i=1}^{N} a_i x[n-i]$, write down the transfer function.

(69) For discrete system equation $\sum_{i=1}^{M} b_i y[n-i] = \sum_{i=1}^{N} a_i x[n-i]$, what are the zeros and poles?

(70) Find the Z-transform of $\delta[n]$

(71) Find the Z-transform of $u[n]$

(72) Find the Z-transform of $a^n u[n]$, $a < 1$

(73) Find the Z-transform of $r[n]$ $(r[n] = nu[n])$

(74) Solve $1 + z^{-1} + z^{-2} = 0$

(75) Solve $1 + z^{-1} + z^{-2} + z^{-3} = 0$

(76) Solve $1 + z^{-1} + z^{-2} + z^{-3} + z^{-4} = 0$

(77) What is partial fraction?

(78) $a, b > 0$, perform fast partial fraction on $\frac{1}{(z^{-1}+a)(z^{-1}+b)}$, draw the zeros and poles in the complex plane

(79) $a, b, c > 0$, perform fast partial fraction on $\frac{1}{(z^{-1}+a)(z^{-1}+b)(z^{-1}+c)}$, draw the zeros and poles in the complex plane

(80) $a, b, c > 0$, perform fast partial fraction on $\frac{z^{-1}+c}{(z^{-1}+a)(z^{-1}+b)}$, draw the zeros and poles in the complex plane

(81) $a, b, c > 0$, perform fast partial fraction on $\frac{z^{-1}+c}{(z^{-1}+a)(z^{-1}+b)(z^{-1}+d)}$, draw the zeros and poles in the complex plane

(82) $a, b, c > 0$, perform fast partial fraction on $\frac{1}{(z^{-1}+a)^2(z^{-1}+b)}$, draw the zeros and poles in the complex plane

(83) $a, b, c > 0$, perform fast partial fraction on $\frac{1}{(z^{-1}+a)^2(z^{-1}+b)^2}$, draw the zeros and poles in the complex plane

(84) Using words, describe the process of doing inverse Z-Transform by partial fraction and table look-up

(85) What does "frequency response" means?

(86) What is the relationships between $h(t)$ and $H(e^{j\omega})$? (Note. Some book write $H(e^{j\omega})$ as $H(\omega)$)

(87) What are the relationships between $h[n]$, $H(z)$ and $H(e^{j\omega})$? (Note. Some book write $H(e^{j\omega})$ as $H(\omega)$)

(88) What does "magnitude response" means?

(89) What does "phase response" means?

(90) What is the output of a system $H(e^{j\omega})$ if the input is $A\cos(\omega_0 t + \phi_0)$? Write down the expression of the output.

(91) What is the output of a system $H(e^{j\omega})$ if the input is $A\cos(\omega_0 n + \phi_0)$? Write down the expression of the output.

(92) For signal $f[n] = A\sin[2\pi f_1 n + \phi] + B\cos[2\pi f_2 n + \phi_2]$ is this signal periodic ? If yes, what is the period of this signal? Plot the spectrum

(93) For signal $f[n] = A\sin[2\pi f_1 n + \phi]\cos[2\pi f_2 n + \phi_2]$ is this signal periodic ? If yes, what is the period of this signal? Plot the spectrum

(94) Given the Fourier Transform of $x(t)$ is $X(\omega)$, find the Fourier Transform of $x(t-\alpha)$, $\frac{d}{dt}x(t)$ and $\int_0^\tau x(t)dt$

(95) Given the Z-Transform of $x[n]$ is $X(z)$, find the Z-Transform of $x[n-k]$ and $x[n+k]$ (k is positive)

(96) What is inverse Fourier Transform ? Write it down

(97) Given $H(\omega) = \begin{cases} 1 & |\omega| \le \omega_c \\ 0 & \text{else} \end{cases}$, where ω_c denote the cut-off frequency, plot it out in frequency domain

(98) Given $H(\omega) = \begin{cases} 1 & |\omega| \le \omega_c \\ 0 & \text{else} \end{cases}$, find $h(t)$ by inverse Fourier Transform , express $h(t)$ as as a function of $\text{sinc}t$ $\left(\text{sinc}\theta = \frac{\sin\theta}{\theta}\right)$

(99) For Fourier Transform pairs $x(t)$ and $X(\omega)$, what is the Parseval Theorem ? Write it down

(100) For Z-Transform paris $x[n]$ and $X(z)$, what is the Parseval Theorem ? Write it down