Please carefully read the following instructions and guidelines:

1. *This quiz is closed books/notes.*
2. *You will not get a negative mark for choosing the incorrect answer.*
3. *Each question carries 1 mark.*

Best of Luck!

Question 1:

Consider the signal $x(t) = 4 - 2\cos(\omega_0 t)$. Based on the pattern matching method for Fourier series decomposition, which of the following sets of Fourier coefficients is correct?

A) $a_0 = 4, a_1 = 1, a_{-1} = 1$, and $a_k = 0$ for all other k
B) $a_0 = 4, a_1 = -1, a_{-1} = -1$, and $a_k = 0$ for all other k
C) $a_0 = 2, a_1 = -2, a_{-1} = -2$, and $a_k = 0$ for all other k
D) $a_0 = 0, a_1 = 2, a_{-1} = 2$, and $a_k = 0$ for all other k

Note that:
$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk\omega_0 t} \qquad a_k = \frac{1}{T}\int_0^T x(t)e^{-jk\omega_0 t}dt$$

Question 2:

Which of the following conditions is **NOT** a valid reason why the Fourier series may fail to converge for a given signal?

A) The signal has an infinite number of discontinuities distributed over each period.
B) The signal approaches an asymptote, leading to an infinite area under the curve over one period.
C) The signal exhibits infinite oscillations (wiggling) as it approaches the end of its period.
D) The signal contains a finite number of discontinuities, but they occur at the same points in every period.

Question 3:

Consider the continuous signal $x(t)$. Which of the following statements about the Fourier transform and inverse Fourier transform is **correct**?

A) The Fourier transform can only be applied to finite-length periodic signals, and it produces a discrete set of coefficients a_k.
B) The inverse Fourier transform converts the signal from the omega domain to the time domain using the formula $X(\omega) = \int_{-\infty}^{\infty} x(t)e^{-j\omega t}dt$.
C) The Fourier transform applies to both finite-length and infinite-length aperiodic signals, producing a continuous function $X(\omega)$ in the frequency domain.
D) A periodic signal $x(t)$ will always have a Fourier series representation, regardless of whether it is finite or infinite in duration.

Question 4:

Which of the following statements correctly describes the Duality Property in signal processing?

A) A delta function in the time domain results in a constant function in the frequency domain.

B) A pair of impulses in the time domain corresponds to a cosine in the frequency domain, and a cosine in the time domain corresponds to a regular non-repeating pulse in the frequency domain.

C) A pulse in the frequency domain results in a constant in the time domain.

D) A sinc function in the time domain results in a delta function in the frequency domain.

Question 5:

We know that the Fourier transform of e^{-at} is $\frac{1}{a+j\omega}$. Given the input signal $x(t) = 2e^{-4t}u(t)$ and the impulse response $h(t) = 8e^{-2t}u(t)$, the output response $Y(\omega)$ in the frequency domain is given by what expression?

A) $\frac{8}{(4+j\omega)(2+j\omega)}$

B) $\frac{12}{(4+j\omega)(2+j\omega)}$

C) $\frac{4}{(4+j\omega)(2+j\omega)}$

D) $\frac{16}{(4+j\omega)(2+j\omega)}$

End of Questions

Answer Sheet:

Question Number	A	B	C	D
1		■		
2				■
3			■	
4	■			
5				■