Assignment 04

The due date for submitting this assignment has passed. **Due on 2017-08-25, 23:59 IST**
As per our records you have not submitted this assignment.

**Note:** For multiple-choice questions, square boxes for choices imply that one or more choices could be correct. You will get full marks only when all the correct answers are chosen. Radio buttons (circles) for choices imply that only one choice is correct. Note that the text for each choice appears either on the right or below the corresponding button. For the short-answer questions, you need to enter the answer in a text box. Please take care to enter the answer without spaces because the server simply checks for exact text match. Please ask questions on the forum if the required format for answers is confusing.

All the best.

**Notation:** $T_0$ refers to the fundamental period of a periodic signal and $\omega_0, f_0$ are the corresponding fundamental frequencies in radians/seconds and Hz respectively, where $\omega_0 = 2\pi f_0$.

Unless otherwise stated, all voltages are in volts and currents in amperes.

1) Consider the exponential Fourier series of a periodic signal $f(t) = \sum_{n=-\infty}^{\infty} c_n e^{j n \omega_0 t}$. Let $\sum_{n=0}^{\infty} |a_n \cos(n \omega_0 t) + b_n \sin(n \omega_0 t)|$ be the corresponding trigonometric Fourier series expansion. What is the correct relationship between $c_n, a_n, b_n$ for $n > 0$?

- $c_n = a_n + j b_n$
- $c_n = a_n - j b_n$
- $2c_n = a_n + j b_n$
- $2c_n = a_n - j b_n$

**No, the answer is incorrect.**

**Score:** 0

**Accepted Answers:**

- $2c_n = a_n - j b_n$

2) Consider the exponential Fourier series expansion of a periodic signal $f(t) = \sum_{n=-\infty}^{\infty} c_n e^{j n \omega_0 t}$. What is the expression for $c_n$?

- $c_n = \frac{2}{T_0} \int_{0}^{T_0} f(t) e^{-j n \omega_0 t} dt$
- $c_n = \frac{2}{T_0} \int_{0}^{T_0} f(t) e^{j n \omega_0 t} dt$
- $c_n = \frac{1}{T_0} \int_{0}^{T_0} f(t) e^{j n \omega_0 t} dt$
- $c_n = \frac{1}{T_0} \int_{0}^{T_0} f(t) e^{-j n \omega_0 t} dt$
**Week 4: Fourier Series IV**

**Week 4: Fourier Series V**

**Week 4: Fourier Series VI**

**Quiz : Assignment 04**

**Solutions to Assignment-04**

**Week5: Fourier Series VII**

**Week5: Fourier Transform I**

**Week5: Fourier Transform II**

**Week5: Fourier Transform III**

**Week5: Fourier Transform IV**

**Week5: Fourier Transform V**

**Week 6: Assignment**

**Week 6: Fourier Transform VI**

**Week 6: Fourier Transform VII**

**Week 6: Fourier Transform VIII**

**Week 7: Assignment**

**Week 7: Fourier Transform IX**

**Week 7: Fourier Transform X**

**Week 7: Fourier Transform XI**

**Week 8 - Laplace Transform I**

**Week 8 - Laplace Transform II**

**Week 8: Assignment**

**Week 9: Laplace Transform III**

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**27/07/2020**

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\[ c_n = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} f(t) e^{-jn\omega_0 t} dt \]

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

\[ c_n = \frac{1}{T_0} \int_{0}^{T_0} f(t) e^{-jn\omega_0 t} dt \]

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3) A signal \( f(t) \) is such that it is real valued satisfying \( f(t) = -f(-t) \) (i.e., odd symmetric). Identify the correct statement/s about its Fourier frequency spectrum.

- The frequency spectrum is real valued.
- The frequency spectrum is purely imaginary.
- The frequency spectrum has odd-symmetry.
- The frequency spectrum has even-symmetry.

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

The frequency spectrum is purely imaginary.
The frequency spectrum has odd-symmetry.

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4) Consider the signal \( x(t) \) shown below. What is the value of exponential Fourier series coefficient \( c_n \) in \( f(t) = \sum_{n=-\infty}^{\infty} c_n e^{jn\omega_0 t} \)?

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\[ c_0 = 0 \]

\[ c_0 = A \]

\[ c_n = \frac{2A}{jn\pi}, \text{ } n \text{ odd} \]

\[ c_n = \frac{2A}{jn\pi}, \text{ } n \text{ even except } n = 0 \]

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

\[ c_0 = A \]

\[ c_n = \frac{2A}{jn\pi}, \text{ } n \text{ odd} \]

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5) Consider a real-valued signal whose exponential Fourier series coefficients are given as follows:

\[ c_0 = 2, \ c_1 = 1 + j, \ c_{-2} = -1 + j \]. Find the value of \( c_0^2 + c_{-1}^2 + c_2^2 \).

Avoid spaces or any other characters

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**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

\( \text{(Type: String) 4} \)
6) If \( f(t) \) with exponential Fourier series coefficients \( c_n \) is as shown in the figure on the left, and \( g(t) \) with exponential Fourier series coefficients \( d_n \) is as shown in the figure on the right, select the options that show correct relationship between the Fourier series coefficients of the two signals.

\[
f(t) = A \text{rect}(t - \frac{T_0}{2}) - A \text{rect}(t + \frac{T_0}{2})
g(t) = A \text{rect}(t - \frac{3T_0}{4}) - A \text{rect}(t + \frac{3T_0}{4})
\]

- \( d_0 = 1 \)
- \( d_1 = c_1 \)
- \( d_2 = 0 \)
- \( d_3 = -j c_3 \)

No, the answer is incorrect.
Score: 0

Accepted Answers:
\( d_2 = 0 \)
\( d_3 = -j c_3 \)

7) Let \( f(t) \) be an unknown real valued signal. Furthermore, we are given fourier series coefficients of \( \frac{df}{dt} \). Choose the correct statement about \( c_0 \), which is one of the fourier series coefficients of \( f(t) \).

\( c_0 \) can always be correctly calculated from the given information.
\( c_0 \) cannot be exactly calculated from the given information.

No, the answer is incorrect.
Score: 0

Accepted Answers:
\( c_0 \) cannot be exactly calculated from the given information.

8) In the figure below, \( f(t) = f(t + T_0) \) and \( A = T_0 = 1 \). Choose the correct values of the exponential Fourier series coefficients.
9) Consider the circuit shown below. The input is \( V_s(t) = 10 \sin(10t) + 20 \cos(10\sqrt{3}t) \). What is the average power dissipated in the resistor?

- 3.75
- 7.5
- 15
- 30

No, the answer is incorrect.
Score: 0

Accepted Answers:
- 7.5

10) The plot of \( \frac{d f}{d t} \) is shown below. Let \( c_n \) be the exponential fourier series coefficients of \( f(t) \). What is the decay rate of \( |c_n| \), where \( M \) is a suitably defined constant?

No, the answer is incorrect.
Score: 0

Accepted Answers:
- 7.5
\( |c_n| \leq \frac{M}{n} \)

\( |c_n| \leq \frac{M}{n^2} \)

\( |c_n| \leq \frac{M}{n^3} \)

\( |c_n| \leq \frac{M}{n^4} \)

No, the answer is incorrect.

Score: 0

Accepted Answers:

\( |c_n| \leq \frac{M}{n^3} \)