ECE 102 HW4

LIANG, NEVIN

TOTAL POINTS

98 / 100

QUESTION 1

Problem 1 28 pts

1.1 (a)(i) 9 / 9

✓ - **0 pts** Correct
- **2 pts** wrong sign with 4, -4
- **2 pts** wrong value with 4, -4
- **2 pts** wrong value with 5, -5
- **1 pts** wrong scale with 4
- **1 pts** efficient of 4, -4 should include j / i
- **2 pts** efficient not separated.
- **2 pts** Not simplified
- **2 pts** wrong sign with -4

1.2 (a)(ii) 9 / 9

✓ - **0 pts** Correct
- **1 pts** e^-2
- **1.5 pts** Not simplified answer
- **1 pts** wrong sign with j*2*pi*k
- **1 pts** wrong sign with e^-2
- **1 pts** wrong value when k != 0
- **1 pts** wrong value with j*2*pi*k
- **1 pts** wrong value of e^-2
- **0 pts** Click here to replace this description.

1.3 (a)(iii)(Optional) 0 / 0

✓ - **0 pts** Correct

1.4 (b)(i) 5 / 5

✓ - **0 pts** Correct
- **1 pts** not simplified
- **3 pts** wrong answer
- **5 pts** no answer
- **0 pts** Click here to replace this description.

1.5 (b)(ii) 5 / 5

✓ - **0 pts** Correct
- **1 pts** wrong answer for odd
- **1 pts** wrong answer for even
- **5 pts** No answer
- **1 pts** Not simplified

QUESTION 2

Problem 2 20 pts

2.1 (a) 5 / 5

✓ - **0 pts** Correct
- **2 pts** Wrong answer
- **5 pts** No answer

2.2 (b) 3 / 5

- **0 pts** Correct

✓ - **2 pts** wrong answer
- **5 pts** no answer

2.3 (c) 5 / 5

✓ - **0 pts** Correct
- **2 pts** wrong answer
- **5 pts** no answer

2.4 (d) 5 / 5

✓ - **0 pts** Correct
- **2 pts** wrong answer
- **5 pts** no answer

QUESTION 3

Problem 3 10 pts

3.1 (a) 5 / 5

✓ - **0 pts** Correct
- **2 pts** Wrong proof
- **5 pts** No answer

3.2 (b) **5 / 5**

- ✓ **- 0 pts** Correct
- **- 2 pts** Wrong proof
- **- 5 pts** No Answer

QUESTION 4

Problem 4 29 pts

4.1 (a)(i) **5 / 5**

- ✓ **- 0 pts** Correct
- **- 5 pts** incorrect or no answer
- **- 1 pts** partially correct

4.2 (a)(ii) **5 / 5**

- ✓ **- 0 pts** Correct
- **- 5 pts** no answer

4.3 (a)(iii) **5 / 5**

- ✓ **- 0 pts** Correct
- **- 2 pts** LTI not proved
- **- 1 pts** incorrect or no h_eq(t)
- **- 1 pts** linearity not proved
- **- 1 pts** Time invariance not proved
- **- 5 pts** no answer

4.4 (a)(iv)(Optional) **0 / 0**

- ✓ **- 0 pts** Correct

4.5 (b)(i) **7 / 7**

- ✓ **- 0 pts** Correct
- **- 2 pts** partially incorrect plot with steps shown
- **- 3 pts** even function property not applied
- **- 0.5 pts** scales/ numbers on the horizontal axis
- **- 3 pts** odd harmonics property not applied
- **- 7 pts** no answer
- **- 4 pts** partially correct
- **- 1 pts** incorrect points T/4 and T/2

4.6 (b)(ii) **7 / 7**

- ✓ **- 0 pts** Correct
- **- 1 pts** minor error in the plot
- **- 2 pts** partially correct, steps shown
- **- 3 pts** odd function property not applied
- **- 3 pts** odd harmonics property not applied
- **- 4 pts** partially correct
- **- 0.5 pts** no numbers on the horizontal axis
- **- 7 pts** no answer

QUESTION 5

Problem 5 13 pts

5.1 (a) **6 / 6**

- ✓ **- 0 pts** Correct
- **- 6 pts** No answer
- **- 3 pts** No code.

5.2 (b) **7 / 7**

- ✓ **- 0 pts** Correct
- **- 2 pts** incorrect plots
- **- 1 pts** N=50 plot not periodic
- **- 0.5 pts** incorrect sawtooth function
- **- 3 pts** no plots
- **- 3 pts** no code
- **- 7 pts** no answer

5.3 (c)(Optional) **0 / 0**

- ✓ **- 0 pts** Correct

EE 102 HW4 Nevin Liang

1. (a.) i. $f(t) = \cos(5\pi t) + \frac{1}{2}\sin(4\pi t)$

$$= \frac{e^{i \cdot 5\pi} - e^{i \cdot 5\pi}}{2} + \frac{e^{i4\pi} - e^{i \cdot 4\pi}}{4i}$$

$$C_5 = \frac{1}{2} \quad C_{-5} = \frac{1}{2} \quad C_4 = \frac{1}{4i} = \frac{-j}{4} \quad C_{-4} = \frac{j}{4}$$

ii. $f(t) = e^{-2t}$

$$C_k = \frac{1}{T_0}\int_0^1 f(t) \cdot e^{-jk\omega_0 t}\,dt = \int_0^1 e^{-2t} \cdot e^{-jk \cdot 2\pi \cdot t}\,dt$$

$$T = 1 \quad T = \frac{2\pi}{\omega} \Rightarrow \omega = 2\pi \qquad = \frac{1 - e^{-2jk\pi - 2}}{2(jk\pi + 1)}$$

$$= \frac{1 - e^{-2jk\pi} \cdot e^{-2}}{2(jk\pi + 1)} = \frac{1 - e^{-2}}{2(1 + jk\pi)}$$

iii. $f(t) = 2 - u(t-1) - u(t-2)$

$$C_k = \frac{1}{3}\int_0^3 [2 - u(t-1) - u(t-2)] \cdot e^{-jk\omega_0 t}\,dt$$

$$= \int_0^1 + \int_1^2 + \int_2^3 = \frac{1}{2jk\pi}\left[e^{-4jk\pi/3}\left(e^{2jk\pi/3} - 1\right)\left(2e^{2jk\pi/3} + 1\right)\right]$$

(b) i. $\cancel{X} = Z_k = \frac{1}{T_0}\int_0^{T_0} f(t) \cdot e^{-jk\omega_0 t}\,dt = \boxed{X_k + Y_k}$

ii. $\omega \cancel{Z_k} = \frac{1}{T_0}\int_0^{T_0} [x(t) + y(t)]\, e^{-jk\omega_0 t}\,dt = \frac{1}{T_0}[2X_k + Y_k]$

$$T_0 = T_2 = 2T_1 \qquad \frac{1}{T_1}\int_0^{T_1} x(t) \cdot e^{-jk\omega_0 t}\,dt = X_k T_1$$

$$\frac{2X_k T_1}{T_0} = X_k \qquad \boxed{X_k + Y_k} \qquad \frac{X_k}{2}$$

1.1 (a)(i) **9 / 9**

- ✓ **- 0 pts** Correct
- **- 2 pts** wrong sign with 4, -4
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ii. $w\,\cancel{z}_k = \frac{1}{T_0}\int_0^{T_0}[x(t)+y(t)]\,e^{-jkw_0 t}\,dt = \frac{1}{T_0}[2x_k + y_k]$

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$\frac{2X_k T_1}{T_0} = X_k \qquad \cancel{\boxed{X_k + Y_k}} \qquad \frac{X_k}{2}$

1.3 (a)(iii)(Optional) 0 / 0

✓ **- 0 pts** Correct

EE 102 HW4 Nevin Liang

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(b) i. $\cancel{X} = z_k = \frac{1}{T_0}\int_0^{T_0} f(t)\cdot e^{-jkw_0 t}\,dt = \boxed{x_k + y_k}$

ii. $\cancel{w z_k = \frac{1}{T_0}\int_0^{T_0}[x(t)+y(t)]\,e^{-jkw_0 t}\,dt = \frac{1}{T_0}[2x_k + y_k]}$

$\cancel{T_0 = T_2 = 2T_1 \quad \frac{1}{T_1}\int_0^{T_1} x(t)\cdot e^{-jkw_0 t}\,dt = X_k T_1}$

$\cancel{\frac{2X_k T_1}{T_0} = X_k \quad \boxed{X_k + y_k} \quad \frac{X_k}{2}}$

1.4 (b)(i) **5 / 5**

- ✓ **- 0 pts** Correct
- **- 1 pts** not simplified
- **- 3 pts** wrong answer
- **- 5 pts** no answer
- **- 0 pts** Click here to replace this description.

(ii.) $w_0 = \frac{1}{2}w_1 = w_2$

$$x(t) = \sum_{-\infty}^{\infty} x_k e^{jkw_1 t} = \sum_{-\infty}^{\infty} x_k e^{2jw_0 t}$$

$$y(t) = \sum_{-\infty}^{\infty} y_k e^{jkw_0 t}$$

$$w(t) = \sum_{-\infty}^{\infty} x_k e^{j2kw_0 t} + y_k e^{jkw_0 t}$$

$k' = 2k$

$$\Rightarrow \sum_{\text{even}} x_{k/2} e^{jkw_0 t} + \sum_{-\infty,\infty} y_k e^{jkw_0 t}$$

$$w_k = \begin{cases} x_{k/2} + y_k & \text{even } k \\ y_k & \text{odd } k. \end{cases}$$

1.5 (b)(ii) **5 / 5**

- ✓ **- 0 pts** Correct
- **- 1 pts** wrong answer for odd
- **- 1 pts** wrong answer for even
- **- 5 pts** No answer
- **- 1 pts** Not simplified

2. (a) $g(t)$ period: T_0..

$$g(t) = \sum_{k=-\infty}^{\infty} 2c_k \cdot e^{jw_0kt}$$

(b) $g(t)$ period: $T_0/2$

$$g(t) = \sum_{k=-\infty}^{\infty} \cancel{2}c_k \cdot e^{-jw_0 \cdot k \cdot t \cdot 2} \qquad \cancel{m = 2k}$$

$$\cancel{= \sum_{m=-\infty}^{\infty} C_{(-m/2)} e^{+jw_0 mt}}$$

$$\cancel{= \sum_{k=-\infty}^{\infty} C_{-k/2} e^{jw_0kt}}$$

$$= \sum_{k=-\infty}^{\infty} c_k \cdot e^{-2jw_0kt}$$

(c) $g(t)$ period: T_0

$$g(t) = \sum_{k=-\infty}^{\infty} C_k \cdot e^{jw_0k(t-t_0)} = \sum_{k=-\infty}^{\infty} C_k \cdot e^{-jw_0kt_0} \cdot e^{jw_0kt}$$

(d) $g(t)$ period: $a \cdot T_0$

$$g(t) = \sum_{k=-\infty}^{\infty} C_k \cdot e^{jw_0k(t/a)}$$

2.1 (a) **5 / 5**

✓ **- 0 pts** Correct

- 2 pts Wrong answer

- 5 pts No answer

2. (a) $g(t)$ period: T_0..

$$g(t) = \sum_{k=-\infty}^{\infty} 2c_k \cdot e^{jw_0kt}$$

(b) $g(t)$ period: $T_0/2$

$$g(t) = \sum_{k=-\infty}^{\infty} \cancel{2}c_k \cdot e^{-jw_0 \cdot k \cdot t \cdot 2} \quad \cancel{m = 2k}$$

$$= \cancel{\sum_{m=-\infty}^{\infty} C_{(-m/2)} e^{+jw_0 mt}}$$

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$$g(t) = \sum_{k=-\infty}^{\infty} C_k \cdot e^{jw_0k(t/a)}$$

2.2 (b) **3 / 5**

- **- 0 pts** Correct
- ✓ **- 2 pts wrong answer**
- **- 5 pts** no answer

2. (a) $g(t)$ period: T_0..

$$g(t) = \sum_{k=-\infty}^{\infty} 2c_k \cdot e^{jw_0kt}$$

(b) $g(t)$ period: $T_0/2$

$$g(t) = \sum_{k=-\infty}^{\infty} \cancel{2} c_k \cdot e^{-jw_0 \cdot k \cdot t \cdot 2} \qquad \cancel{m = 2k}$$

$$\cancel{= \sum_{m=-\infty}^{\infty} C_{(-m/2)} e^{+jw_0 mt}}$$

$$= \sum_{k=-\infty}^{\infty} c_k \cdot e^{-2jw_0kt}$$

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$$g(t) = \sum_{k=-\infty}^{\infty} C_k \cdot e^{jw_0k(t-t_0)} = \sum_{k=-\infty}^{\infty} C_k \cdot e^{-jw_0kt_0} \cdot e^{jw_0kt}$$

(d) $g(t)$ period: $a \cdot T_0$

$$g(t) = \sum_{k=-\infty}^{\infty} C_k \cdot e^{jw_0k(t/a)}$$

2.3 (c) **5 / 5**

- ✓ **- 0 pts** Correct
- **- 2 pts** wrong answer
- **- 5 pts** no answer

2. (a) $g(t)$ period: T_0..

$$g(t) = \sum_{k=-\infty}^{\infty} 2c_k \cdot e^{jw_0kt}$$

(b) $g(t)$ period: $T_0/2$

$$g(t) = \sum_{k=-\infty}^{\infty} \cancel{2}c_k \cdot e^{-jw_0 \cdot k \cdot t \cdot 2} \qquad \cancel{m = 2k}$$

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(d) $g(t)$ period: $a \cdot T_0$

$$g(t) = \sum_{k=-\infty}^{\infty} C_k \cdot e^{jw_0k(t/a)}$$

2.4 (d) **5 / 5**

✓ **- 0 pts** Correct

- 2 pts wrong answer

- 5 pts no answer

3. (a)

$$y(t) = \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau)\, d\tau$$

$$= \int_{-\infty}^{\infty} h(\tau) \cdot \cos(\omega_0 \cdot (t-\tau))\, d\tau$$

$$\cos(\omega_0(t-\tau)) = \frac{e^{i(\omega_0(t-\tau))} - e^{-i(\omega_0(t-\tau))}}{2}$$

$$= \int_{-\infty}^{\infty} h(\tau) \cdot \tfrac{1}{2} e^{j(\omega_0)(t-\tau)} - h(\tau) \cdot \tfrac{1}{2} e^{j(\omega_0)(\tau-t)}\, d\tau$$

$$= \tfrac{1}{2} e^{j\omega_0 t} \left[\int_{-\infty}^{\infty} h(\tau) \cdot e^{-j\omega_0 \tau} - h(\tau) \cdot e \ldots \right]$$

$$= \tfrac{1}{2} a\, e^{j\omega_0 t} + \tfrac{1}{2} b\, e^{-j\omega_0 t}$$ not linear scaled from $\frac{e^{j\omega_0(t \cancel{-\tau})}}{2} + \frac{e^{-j\omega_0(t)}}{2}$

so $\boxed{NO}$

(b) $$y(t) = \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau)\, d\tau = \int_{-\infty}^{\infty} h(\tau) \cdot (t-\tau)\, d\tau = t \int_{-\infty}^{\infty} h(\tau)\, d\tau$$

$$-1 \cdot \int_{-\infty}^{\infty} h(\tau) \cdot \tau\, d\tau$$

$= at - b$ which isn't linear scales from t.

$\boxed{NO}$

3.1 (a) **5 / 5**

✓ **- 0 pts** Correct

- 2 pts Wrong proof

- 5 pts No answer

3. (a) $y(t) = \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau)\, d\tau$

$= \int_{-\infty}^{\infty} h(\tau) \cdot \cos(w_o \cdot (t-\tau))\, d\tau$

$\cos(w_o(t-\tau)) = \dfrac{e^{i(w_o(t-\tau))} - e^{-i(w_o(t-\tau))}}{2}$

$= \int_{-\infty}^{\infty} h(\tau) \cdot \frac{1}{2} e^{j(w_o)(t-\tau)} - h(\tau) \cdot \frac{1}{2} e^{j(w_o)(\tau - t)}\, d\tau$

$= \frac{1}{2} \cdot e^{jw_o t} \left[\int_{-\infty}^{\infty} h(\tau) \cdot e^{-jw_o \tau} - h(\tau) \cdot e \ldots \right]$

$= \frac{1}{2} a\, e^{jw_o t} + \frac{1}{2} b\, e^{-jw_o t}$. not linear scaled

from $\dfrac{e^{jw_o(t \cancel{-\tau})}}{2} + \dfrac{e^{-jw_o(t)}}{2}$

so $\boxed{NO}$

(b) $y(t) = \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau)\, d\tau = \int_{-\infty}^{\infty} h(\tau) \cdot (t-\tau)\, d\tau = +\int_{-\infty}^{\infty} h(\tau)\, d\tau$

$-1 \cdot \int_{-\infty}^{\infty} h(\tau) \cdot \tau\, d\tau$

$= at - b$ which isn't linear scales from t.

$\boxed{NO}$

3.2 (b) **5 / 5**

✓ **- 0 pts** Correct

- 2 pts Wrong proof

- 5 pts No Answer

4. (a) i. $y(t) = H(\cancel{x \cdot e^{t}}) \cdot e^{-t}$

$x(t) \cdot e^{t}$

$= h(t) * [x(t) \cdot e^{t}] \cdot e^{-t}$] definition of impulse

ii. $y(t) = e^{-t} \left[\int_{-\infty}^{\infty} \cancel{h(t)} \cdot x\cancel{(\tau) e^{\tau}} \cdot h(\right.$

$\left. h(\tau) \cdot x(t-\tau) \cdot e^{t-\tau} \, d\tau \right]$

$$= \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau) \cdot e^{-\tau} \, d\tau$$

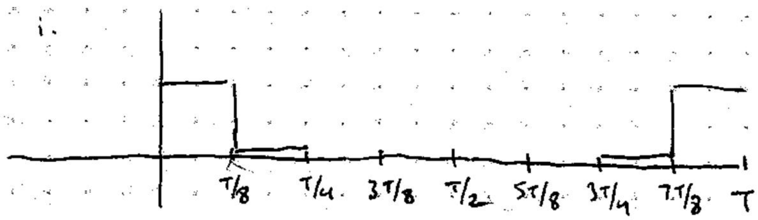
let $h(\tau) \cdot e^{-\tau} = h'(\tau)$.

$$= \int_{-\infty}^{\infty} h'(\tau) \cdot x(t-\tau) \cdot \cancel{e^{t}} \, d\tau$$

iii. $h'(t) = h_{eq}(t)$

it is LTI b/c $x(t)$ is LTI, $e^{-\tau}$, and $h(\tau)$ are all LTI.

(b) i.



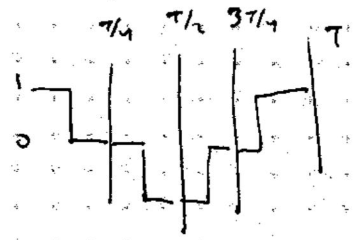
$$C_2 = 0 = \int_0^T x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt$$

$$= \int_0^{T/2} x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt + \int_{T/2}^{T} x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt$$

$$= \quad " \quad " \quad + \int_{0}^{T/2} x(T + T/2) \, e^{-2 j w_0 t} \cdot e^{-j 2 \pi} \, dt$$

$$0 = \int_0^{T/2} x(t) + x(t + T/2) \, e^{-2 j w_0 t} \, dt$$

$x(t) = -x(t - T/2)$ ->



4.1 (a)(i) **5 / 5**

✓ **- 0 pts** Correct

- 5 pts incorrect or no answer

- 1 pts partially correct

4. (a) i. $y(t) = H(\cancel{x \cdot e^{t}}) \cdot e^{-t}$

$x(t) \cdot e^{t}$

$= h(t) * [x(t) \cdot e^{t}] \cdot e^{-t}$] definition of impulse

ii. $y(t) = e^{-t} \left[\int_{-\infty}^{\infty} \cancel{h(t)} \cdot x(\cancel{\tau) e^{t}}) \cdot h(\right.$

$\left. h(\tau) \cdot x(t-\tau) \cdot e^{t-\tau} \, d\tau \right]$

$$= \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau) \cdot e^{-\tau} \, d\tau$$

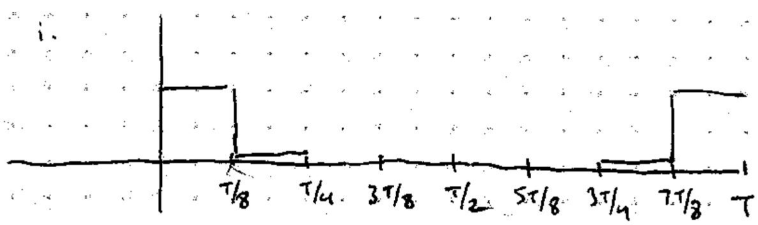
let $h(\tau) \cdot e^{-\tau} = h'(\tau)$.

$$= \int_{-\infty}^{\infty} h'(\tau) \cdot x(t-\tau) \cdot \cancel{e^{-\tau}} \, d\tau$$

iii. $h'(t) = h_{eq}(t)$

it is LTI b/c $x(t)$ is LTI, $e^{-\tau}$, and $h(\tau)$ are all LTI.

(b) i.



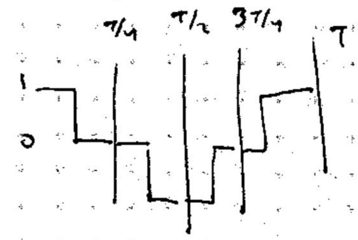
$$C_2 = 0 = \int_0^{T} x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt$$

$$= \int_0^{T/2} x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt + \int_{T/2}^{T} x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt$$

$= \quad " \quad " \quad + \int_{0}^{T/2} x(T + T/2) \, e^{-2 j w_0 t} \cdot e^{-j 2\pi} \, dt$

$$0 = \int_0^{T/2} x(t) + x(t + T/2) \; e^{-2 j w_0 t} \, dt$$

$x(t) = -x(t - T/2) \quad \rightarrow$



4.2 (a)(ii) 5 / 5

✓ **- 0 pts** Correct

- 5 pts no answer

4. (a) i. $y(t) = H(\cancel{x \cdot e^{t}}) \cdot e^{-t}$

$x(t) \cdot e^{t}$

$= h(t) * [x(t) \cdot e^{t}] \cdot e^{-t}$] definition of impulse

ii. $y(t) = e^{-t} \left[\int_{-\infty}^{\infty} \cancel{h(t)} \cdot x\cancel{(\tau) e^{t}} \cancel{h(} \right.$

$\left. h(\tau) \cdot x(t-\tau) \cdot e^{t-\tau} \, d\tau \right]$

$$= \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau) \cdot e^{-\tau} \, d\tau$$

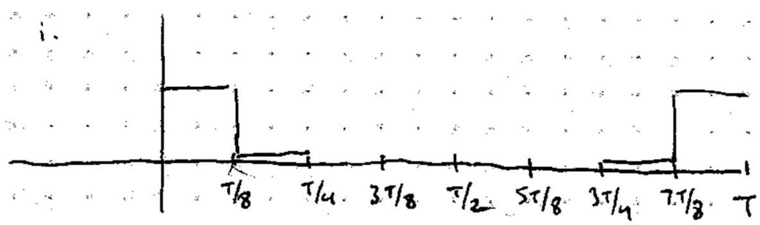
let $h(\tau) \cdot e^{-\tau} = h'(\tau)$.

$$= \int_{-\infty}^{\infty} h'(\tau) \cdot x(t-\tau) \cdot \cancel{e^{-\tau}} \, d\tau$$

iii. $h'(t) = h_{eq}(t)$

it is LTI b/c $x(t)$ is LTI, $e^{-\tau}$, and $h(\tau)$ are all LTI.

(b) i.



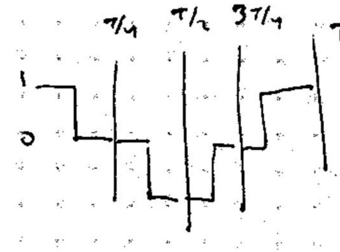
$$C_2 = 0 = \int_0^T x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt$$

$$= \int_0^{T/2} x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt + \int_{T/2}^{T} x(t) \cdot e^{-j \cdot 2 \cdot w_0 t} \, dt$$

$$= \quad " \quad " \quad + \int_{0}^{T/2} x(T + T/2) \, e^{-2 j w_0 t} \cdot e^{-j 2\pi} \, dt$$

$$0 = \int_0^{T/2} x(t) + x(t + T/2) \; e^{-2 j w_0 t} \, dt$$

$x(t) = -x(t - T/2) \; \rightarrow$



4.3 (a)(iii) **5 / 5**

- ✓ **- 0 pts** Correct
- **- 2 pts** LTI not proved
- **- 1 pts** incorrect or no h_eq(t)
- **- 1 pts** linearity not proved
- **- 1 pts** Time invariance not proved
- **- 5 pts** no answer

4.4 (a)(iv)(Optional) **0 / 0**

✓ **- 0 pts** Correct

4. (a) i. $y(t) = H(\cancel{x \cdot e^{t}}) \cdot e^{-t}$

$x(t)\cdot e^{t}$

$= h(t) * [x(t)\cdot e^{t}] \cdot e^{-t}$] definition of impulse

ii. $y(t) = e^{-t}\left[\int_{-\infty}^{\infty} \cancel{h(t)} \cdot x\cancel{(\tau) e^{t}} \cancel{h(}\; h(\tau)\cdot x(t-\tau)\cdot e^{t-\tau}\, d\tau\right]$

$= \int_{-\infty}^{\infty} h(\tau)\cdot x(t-\tau)\cdot e^{-\tau}\, d\tau$

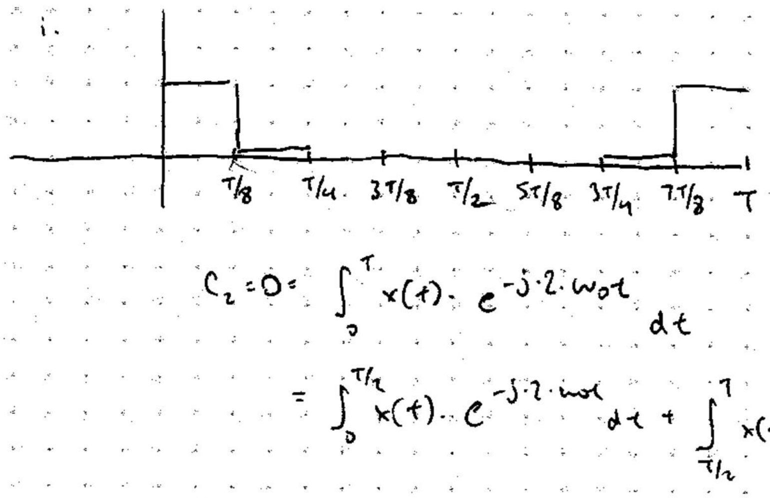
let $h(\tau)\cdot e^{-\tau} = h'(\tau)$.

$= \int_{-\infty}^{\infty} h'(\tau)\cdot x(t-\tau)\cdot \cancel{e^{t}}\, d\tau$

iii. $h'(t) = h_{eq}(t)$

it is LTI b/c $x(t)$ is LTI, $e^{-\tau}$, and $h(\tau)$ are all LTI.

(b) i.



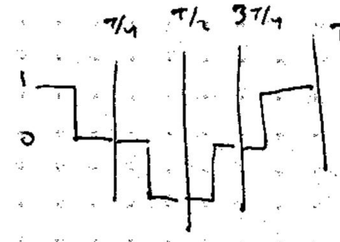
$C_2 = 0 = \int_0^{T} x(t)\cdot e^{-j\cdot 2\cdot w_0 t}\, dt$

$= \int_0^{T/2} x(t)\cdot e^{-j\cdot 2\cdot w_0 t}\, dt + \int_{T/2}^{T} x(t)\cdot e^{-j\cdot 2\cdot w_0 t}\, dt$

$=$ " " $+ \int_{0}^{T/2} x(T+T/2)\, e^{-2jw_0 t}\cdot e^{-j2\pi}\, dt$

$0 = \int_0^{T/2} x(t) + x(t+T/2)\; e^{-2jw_0 t}\, dt$

$x(t) = -x(t-T/2) \rightarrow$



4.5 (b)(i) **7 / 7**

✓ **- 0 pts** Correct

- 2 pts partially incorrect plot with steps shown

- 3 pts even function property not applied

- 0.5 pts scales/ numbers on the horizontal axis

- 3 pts odd harmonics property not applied

- 7 pts no answer

- 4 pts partially correct

- 1 pts incorrect points T/4 and T/2

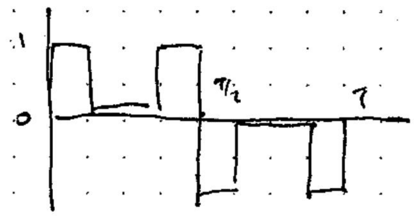
ii. $-x(t) = x(t - T/2)$

$-x(t) = x(-t)$

if $x(t) = -x(t + T/2)$, $x(t - T/2) = -x(t)$

if func is odd $\Rightarrow x(t) = x(-t + T/2)$

func is even $\Rightarrow x(t)$



4.6 (b)(ii) **7 / 7**

✓ **- 0 pts** Correct

- 1 pts minor error in the plot

- 2 pts partially correct, steps shown

- 3 pts odd function property not applied

- 3 pts odd harmonics property not applied

- 4 pts partially correct

- 0.5 pts no numbers on the horizontal axis

- 7 pts no answer

HW 4 Problem 5

part (a)

```
function fn = myfs(Dn,omega0,t)
%
% fn = myfs(Dn,omega0,t)
% % Evaluates the truncated Fourier Series at times t
%
% Dn -- vector of Fourier series coefficients %
% omega0 -- fundamental frequency
% t -- vector of times for evaluation %
% fn -- truncated Fourier series evaluated at t
    N = (length(Dn) - 1) / 2;
    fn = zeros(size(t));
    for k = -N:N
        Ck = Dn(k + N + 1);
        fn = fn + Ck * exp(1i * omega0 * k * t);
    end
end
```

part (b)

```
N = 10;
omega0 = 2 * pi;
kC = 0.5;
nL = -N:1:-1;
nR = 1:1:N;
kL = 1i./(2.*pi.*nL);
kR = 1i./(2.*pi.*nR);
Dn = [kL, kC, kR];
t = -2:0.01:2;
f = myfs(Dn, omega0, t);

subplot(1, 2, 1);
plot(t, f);
```

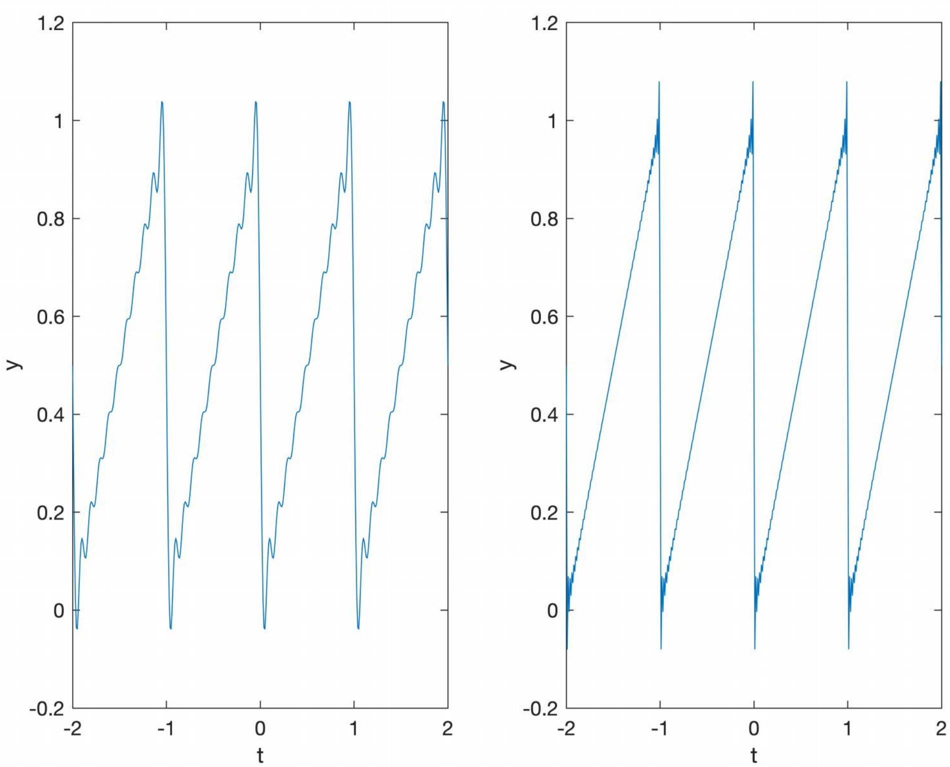
```
Warning: Imaginary parts of complex X and/or Y arguments ignored.
```

```
xlabel('t');
ylabel('y');

N = 50;
omega0 = 2 * pi;
kC = 0.5;
nL = -N:1:-1;
nR = 1:1:N;
kL = 1i./(2.*pi.*nL);
kR = 1i./(2.*pi.*nR);
Dn = [kL, kC, kR];
t = -2:0.01:2;
f = myfs(Dn, omega0, t);

subplot(1, 2, 2);
```

```
plot(t, f);
```

Warning: Imaginary parts of complex X and/or Y arguments ignored.

```
xlabel('t');
ylabel('y');
```



5.1 (a) **6 / 6**

✓ **- 0 pts** Correct

- 6 pts No answer

- 3 pts No code.

HW 4 Problem 5

part (a)

```
function fn = myfs(Dn,omega0,t)
%
% fn = myfs(Dn,omega0,t)
% % Evaluates the truncated Fourier Series at times t
%
% Dn -- vector of Fourier series coefficients %
% omega0 -- fundamental frequency
% t -- vector of times for evaluation %
% fn -- truncated Fourier series evaluated at t
    N = (length(Dn) - 1) / 2;
    fn = zeros(size(t));
    for k = -N:N
        Ck = Dn(k + N + 1);
        fn = fn + Ck * exp(1i * omega0 * k * t);
    end
end
```

part (b)

```
N = 10;
omega0 = 2 * pi;
kC = 0.5;
nL = -N:1:-1;
nR = 1:1:N;
kL = 1i./(2.*pi.*nL);
kR = 1i./(2.*pi.*nR);
Dn = [kL, kC, kR];
t = -2:0.01:2;
f = myfs(Dn, omega0, t);

subplot(1, 2, 1);
plot(t, f);
```

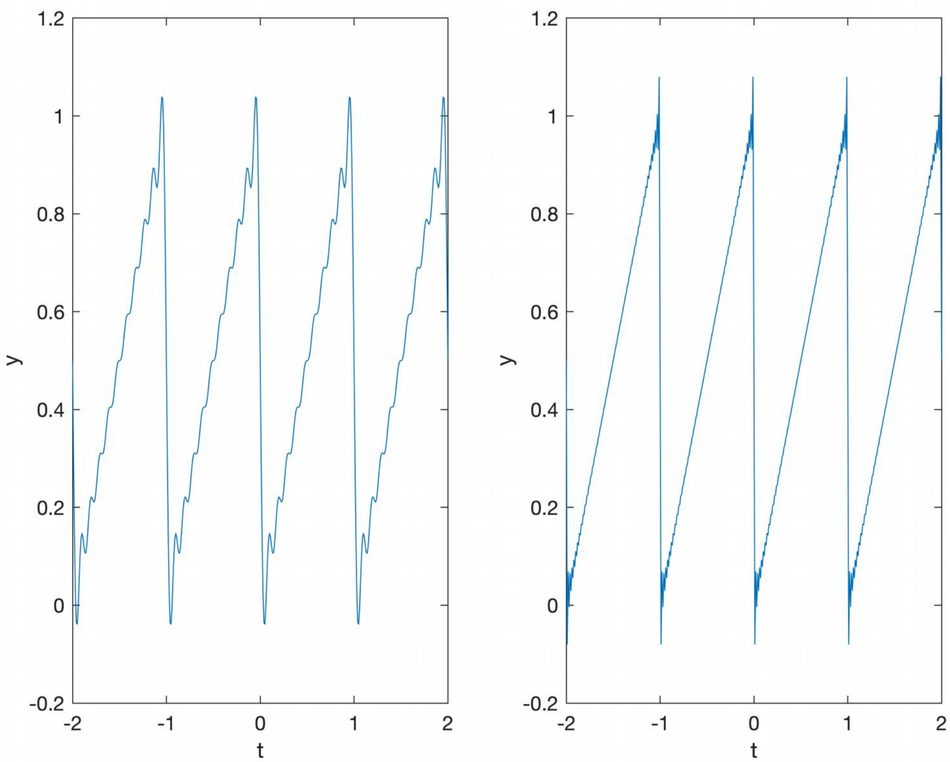
```
Warning: Imaginary parts of complex X and/or Y arguments ignored.
```

```
xlabel('t');
ylabel('y');

N = 50;
omega0 = 2 * pi;
kC = 0.5;
nL = -N:1:-1;
nR = 1:1:N;
kL = 1i./(2.*pi.*nL);
kR = 1i./(2.*pi.*nR);
Dn = [kL, kC, kR];
t = -2:0.01:2;
f = myfs(Dn, omega0, t);

subplot(1, 2, 2);
```

```
plot(t, f);
```

```
Warning: Imaginary parts of complex X and/or Y arguments ignored.
```

```
xlabel('t');
ylabel('y');
```



5.2 (b) **7 / 7**

✓ **- 0 pts** Correct

- 2 pts incorrect plots

- 1 pts N=50 plot not periodic

- 0.5 pts incorrect sawtooth function

- 3 pts no plots

- 3 pts no code

- 7 pts no answer

5.3 (c)(Optional) 0 / 0

✓ - 0 pts Correct