ECE 210/211 HWs HW 5

Student FHF4 PWF2

TOTAL POINTS

57 / 58

QUESTION 1

1 Problem 1 0 / 0

✓ **- 0 pts Correct**

- 0 pts No signature found

QUESTION 2

Problem 2 20 pts

2.1 5 / 5

✓ **- 0 pts Correct**

- 5 pts incorrect

2.2 5 / 5

✓ **- 0 pts Correct**

- 2.5 pts partial

- 5 pts incorrect

2.3 5 / 5

✓ **- 0 pts Correct**

- 5 pts no answer/incorrect answer

- 2 pts mistake in final answer

2.4 5 / 5

✓ **- 0 pts Correct**

- 2 pts Mistake in final answer

- 5 pts no answer/wrong answer

QUESTION 3

Problem 3 20 pts

3.1 5 / 5

✓ **- 0 pts Correct: $$\frac{dv}{dt} + \frac1 3 v(t) = \frac 1 3 \cos(2t-\frac\pi 4) = \frac 1 6 f(t) $$**

- 2 pts Minor Mistake

- 4 pts Incorrect

- 5 pts Cannot find solution

- 0 pts (Please feel free to submit a regrade request)

3.2 5 / 5

✓ **- 0 pts Correct**

- 2.5 pts No/Incorrect $$v_p$$

- 2.5 pts No/Incorrect $$v_h$$

- 2.5 pts partial.

- 3 pts partial. calculation error in both equations

- 1 pts incorrect sign in equation.

- 1.5 pts calculation error in one equation

3.3 5 / 5

✓ **- 0 pts Correct**

- 2.5 pts Incorrect Transient Signal $$v_{tr}(t) = \frac{148+5\sqrt{2}}{74}e^{-\frac{t}{3}}$$

- 2.5 pts Incorrect Steady-State Signal $$v_{SS}(t) = -\frac{5\sqrt{2}}{74}cos(2t) + \frac{7\sqrt{2}}{74}sin(2t)$$

+ 3 pts Correct process, but both parts incorrect due to errors in previous parts

+ 1.5 pts Correct process, but one part incorrect due to errors in previous parts

- 1 pts polarity issues

- 5 pts No signature

3.4 4 / 5

- 0 pts Correct

- 3 pts Refer to answer key.

- 5 pts Missing / Incorrect answer.

- 1 pts Page not assigned.

- 2 pts Error propagating from previous answer.

- 2 pts Incorrect Coefficient(s).

✓ **- 1 pts Incorrect coefficient for exponent term**

- 0.5 pts Partially incorrect coefficient for exponent term

QUESTION 4

Problem 4 9 pts

4.1 3 / 3

✓ **- 0 pts Correct**

- 0.3 pts No/Incorrect Page Assignment

- 3 pts Incorrect

- 1.5 pts Incorrect Coefficient

- 1.5 pts Incorrect angle

4.2 3 / 3

✓ **- 0 pts Correct**

- 1 pts Incorrect phase

- 0.5 pts Did not simplify

- 0.5 pts Sign Error

- 3 pts Did not attempt

- 1 pts Incorrect magnitude

4.3 3 / 3

✓ **- 0 pts Correct**

- 1 pts Wrong coefficient or sign

- 1 pts Wrong imaginary part

- 3 pts Wrong or Blank

- 1 pts Partial credit for reasonable trying

QUESTION 5

Problem 5 9 pts

5.1 3 / 3

✓ **- 0 pts Correct**

- 3 pts Incorrect or no submission

- 1.5 pts Minor error (phase error, amplitude error)

5.2 3 / 3

✓ **- 0 pts Correct**

- 1 pts Incorrect angular frequency

- 1.5 pts Incorrect magnitude

- 1.5 pts Incorrect phase

- 3 pts Incorrect magnitude and phase

- 3 pts No submission

5.3 3 / 3

✓ **- 0 pts Correct**

- 3 pts incorrect

- 0.5 pts no page selected / wrong page selected

- 3 pts didn't express in one cosine function (otherwise there's no point in completing part c after doing part a and part b)

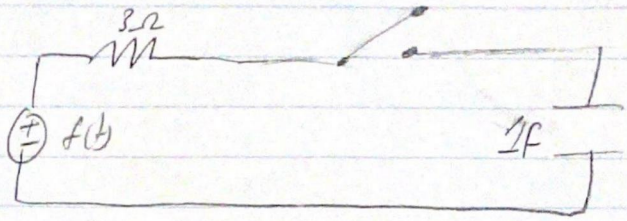
- 0.5 pts blurry image

- 1 pts didn't simplify

02/22/2022 ECE 210 HW5

1. Vacuum fair

2.



$v(0^-) = 3V$, $f(t) = 2\cos(t)$, $\omega = 1$

$\tau = \frac{L}{R} = \frac{1F}{3\Omega} = \frac{1}{3}$ sec

a) ODE for $v(t)$ for $t > 0$:

↳ KVL: $-2\cos(t) - 3\Omega i - v(t) = 0$ → $\frac{d}{dt} = jw$

↳ $2\cos(t) = v(t) + 3i$ ↳ $i_c = C\frac{dv}{dt} = (1)\frac{dv}{dt} = \frac{dv}{dt}$

↳ $2\cos(t) = 3\frac{dv}{dt} + v(t)$

↳ $\boxed{\frac{dv}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v(t)}$

b) $v_p(t)$ and $v_h(t)$ solutions do ODE ↳

↳ $v_h = Ce^{\frac{1}{(1)(3)}} = Ce^{-t/3}$ ← homogeneous → ODE = 0

↳ $v(t) = v_p + v_h$

↳ $\frac{dv_p}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v_p$

characteristic solution

↳ $r + \frac{1}{3} = 0 \rightarrow r = -\frac{1}{3}$

↳ $v_p \rightarrow Ce^{rt} = Ce^{-\frac{1}{3}t}$

↳ $A\cos t + B\sin t = v(t) \rightarrow v'(t) = -A\sin t + B\cos t$

↑ MATH 286 - Diff. Eq. Guess solution

1 Problem 1 0 / 0

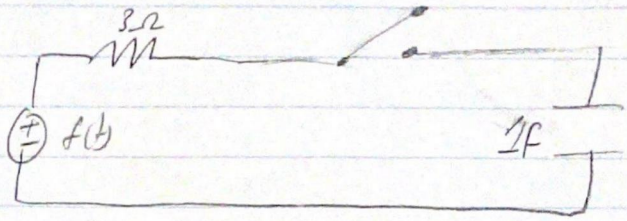
✓ **- 0 pts** **Correct**

- 0 pts No signature found

02/22/2022 ECE 210 HW5

1. Vacuum fair

2.



$v(0^-) = 3V$, $f(t) = 2\cos(t)$, $\omega = 1$

$\tau = \frac{L}{R} = \frac{1F}{3\Omega} = \frac{1}{3}$ sec

a) ODE for $v(t)$ for $t > 0$:

↳ KVL: $-2\cos(t) - 3\Omega i - v(t) = 0$ → $\frac{d}{dt} = jw$

↳ $2\cos(t) = v(t) + 3i$ ↳ $i_c = C\frac{dv}{dt} = (1)\frac{dv}{dt} = \frac{dv}{dt}$

↳ $2\cos(t) = 3\frac{dv}{dt} + v(t)$

↳ $\boxed{\frac{dv}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v(t)}$

b) $v_p(t)$ and $v_h(t)$ solutions do ODE ↳

↳ $v_h = Ce^{\frac{1}{(1)(3)}} = Ce^{-t/3}$ ← homogeneous → ODE = 0

↳ $v(t) = v_p + v_h$

↳ $\frac{dv_p}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v_p$

characteristic solution

↳ $r + \frac{1}{3} = 0 \rightarrow r = -\frac{1}{3}$

↳ $v_p \rightarrow Ce^{rt} = Ce^{-\frac{1}{3}t}$

↳ $A\cos t + B\sin t = v(t) \rightarrow v'(t) = -A\sin t + B\cos t$

↑ MATH 286 - Diff. Eq. Guess solution

2.1 **5 / 5**

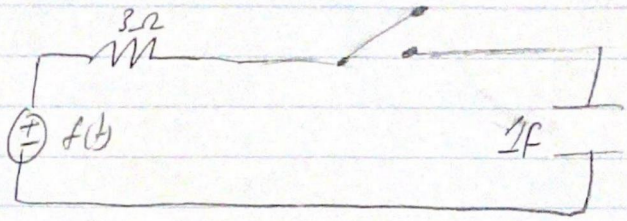
✓ **- 0 pts** **Correct**

- 5 pts incorrect

02/22/2022 ECE 210 HW5

1. Vacuum fair

2.



$v(0^-) = 3V$, $f(t) = 2\cos(t)$, $\omega = 1$

$\tau = \frac{L}{R} = \frac{1F}{3\Omega} = \frac{1}{3}$ sec

a) ODE for $v(t)$ for $t > 0$:

↳ KVL: $-2\cos(t) - 3\Omega i - v(t) = 0$ → $\frac{d}{dt} = jw$

↳ $2\cos(t) = v(t) + 3i$ ↳ $i_c = C\frac{dv}{dt} = (1)\frac{dv}{dt} = \frac{dv}{dt}$

↳ $2\cos(t) = 3\frac{dv}{dt} + v(t)$

↳ $\boxed{\frac{dv}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v(t)}$

b) $v_p(t)$ and $v_h(t)$ solutions do ODE ↳

↳ $v_h = Ce^{\frac{1}{(1)(3)}} = Ce^{-t/3}$ ← homogeneous → ODE = 0

↳ $v(t) = v_p + v_h$

↳ $\frac{dv_p}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v_p$

characteristic solution

↳ $r + \frac{1}{3} = 0 \rightarrow r = -\frac{1}{3}$

↳ $v_p \rightarrow Ce^{rt} = Ce^{-\frac{1}{3}t}$

↳ $A\cos t + B\sin t = v(t) \rightarrow v'(t) = -A\sin t + B\cos t$

↑ MATH 286 - Diff. Eq. Guess solution

2)

b) guess

↳ $V(t)$ of form $A\cos t + B\sin t \rightarrow v'(t) = -A\sin t + B\cos t$

↳ $B\cos t - A\sin t$

$v(t) + v'(t) = A(\cos t - \sin t) + B(\sin t + \cos t)$

$v(t) + v'(t) = 2\cos(t)$

↳ $\frac{dv}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v(t) \rightarrow 3v' = 2\cos t - v(t)$

↳ $3(v'(t) = B\cos t - A\sin t) \rightarrow v(t) + 3v'(t) = 2\cos(t)$

↳ $A\cos t + B\sin t + 3B\cos t - 3A\sin t = 2\cos(t)$

↳ $\sin \begin{cases} B - 3A = 0 \\ \cos \; A + 3B = 2 \end{cases} > 10B = 6, \; B = \frac{3}{5} \rightarrow A = \frac{1}{5}$

↳ $v_h(t) = C_1 e^{-\frac{1}{3}t}$ ← $v = C_1 e^{-rt}$

↳ $v_p(t) = \frac{1}{5}\cos(t) + \frac{3}{5}\sin(t)$

↳ $v(0^-) = v(0) = v(0^+) = 3V_0 / 4\Omega$

↳ $3V = \frac{1}{5} + C_1 \rightarrow C_1 = \frac{14}{5} V_0 / 4\Omega$

↳ $V_h(t) = \frac{14}{5} e^{-\frac{1}{3}t} \; V_0 / 4\Omega$

c) $v(t) = v_p + v_h = \underbrace{\frac{1}{5}\cos(t) + \frac{3}{5}\sin(t)}_{V_{SS}(t)} + \underbrace{\frac{14}{5} e^{-\frac{1}{3}t}}_{V_{TR}(t)}$

d) $i(t) = C\frac{dv}{dt} \Rightarrow -\frac{1}{5}\sin(t) + \frac{3}{5}\cos(t) - \frac{14}{15} e^{-\frac{1}{3}t} = i(t)$

$\Sigma C = 1F$

2.2 5 / 5

✓ **- 0 pts** **Correct**

- 2.5 pts partial

- 5 pts incorrect

2)

b) guess

↳ $V(t)$ of form $A\cos t + B\sin t \rightarrow v'(t) = -A\sin t + B\cos t$

↳ $B\cos t - A\sin t$

$v(t) + v'(t) = A(\cos t - \sin t) + B(\sin t + \cos t)$

$v(t) + v'(t) = 2\cos(t)$

↳ $\frac{dv}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v(t) \rightarrow 3v' = 2\cos t - v(t)$

↳ $3(v'(t) = B\cos t - A\sin t) \rightarrow v(t) + 3v'(t) = 2\cos(t)$

↳ $A\cos t + B\sin t + 3B\cos t - 3A\sin t = 2\cos(t)$

↳ $\sin \begin{cases} B - 3A = 0 \\ \cos \; A + 3B = 2 \end{cases} > 10B = 6, \; B = \frac{3}{5} \rightarrow A = \frac{1}{5}$

↳ $v_h(t) = C_1 e^{-\frac{1}{3}t}$ ← $v = C_1 e^{-rt}$

↳ $v_p(t) = \frac{1}{5}\cos(t) + \frac{3}{5}\sin(t)$

↳ $v(0^-) = v(0) = v(0^+) = 3V_0 / 4\Omega$

↳ $3V = \frac{1}{5} + C_1 \rightarrow C_1 = \frac{14}{5} V_0 / 4\Omega$

↳ $V_h(t) = \frac{14}{5} e^{-\frac{1}{3}t} \; V_0 / 4\Omega$

c) $v(t) = v_p + v_h = \underbrace{\frac{1}{5}\cos(t) + \frac{3}{5}\sin(t)}_{V_{SS}(t)} + \underbrace{\frac{14}{5} e^{-\frac{1}{3}t}}_{V_{TR}(t)}$

d) $i(t) = C\frac{dv}{dt} \Rightarrow -\frac{1}{5}\sin(t) + \frac{3}{5}\cos(t) - \frac{14}{15} e^{-\frac{1}{3}t} = i(t)$

$\Sigma C = 1F$

2.3 5 / 5

✓ **- 0 pts** **Correct**

- 5 pts no answer/incorrect answer

- 2 pts mistake in final answer

2)

b) guess

↳ $V(t)$ of form $A\cos t + B\sin t \rightarrow v'(t) = -A\sin t + B\cos t$

↳ $B\cos t - A\sin t$

$v(t) + v'(t) = A(\cos t - \sin t) + B(\sin t + \cos t)$

$v(t) + v'(t) = 2\cos(t)$

↳ $\frac{dv}{dt} = \frac{2}{3}\cos t - \frac{1}{3}v(t) \rightarrow 3v' = 2\cos t - v(t)$

↳ $3(v'(t) = B\cos t - A\sin t) \rightarrow v(t) + 3v'(t) = 2\cos(t)$

↳ $A\cos t + B\sin t + 3B\cos t - 3A\sin t = 2\cos(t)$

↳ $\sin \begin{cases} B - 3A = 0 \\ \cos \; A + 3B = 2 \end{cases} > 10B = 6, \; B = \frac{3}{5} \rightarrow A = \frac{1}{5}$

↳ $v_h(t) = C_1 e^{-\frac{1}{3}t}$ ← $v = C_1 e^{-rt}$

↳ $v_p(t) = \frac{1}{5}\cos(t) + \frac{3}{5}\sin(t)$

↳ $v(0^-) = v(0) = v(0^+) = 3V_0 / 4\Omega$

↳ $3V = \frac{1}{5} + C_1 \rightarrow C_1 = \frac{14}{5} V_0 / 4\Omega$

↳ $V_h(t) = \frac{14}{5} e^{-\frac{1}{3}t} \; V_0 / 4\Omega$

c) $v(t) = v_p + v_h = \underbrace{\frac{1}{5}\cos(t) + \frac{3}{5}\sin(t)}_{V_{SS}(t)} + \underbrace{\frac{14}{5} e^{-\frac{1}{3}t}}_{V_{TR}(t)}$

d) $i(t) = C\frac{dv}{dt} \Rightarrow -\frac{1}{5}\sin(t) + \frac{3}{5}\cos(t) - \frac{14}{15} e^{-\frac{1}{3}t} = i(t)$

$\Sigma C = 1F$

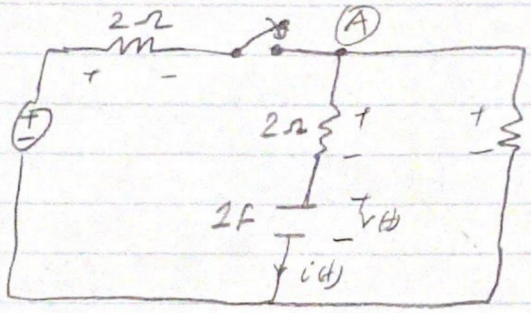
2.4 5 / 5

✓ **- 0 pts** **Correct**

- 2 pts Mistake in final answer

- 5 pts no answer/wrong answer

3. Switch closed at $t=0$, $v(0^-) = 2V$, $f(t) = 2\cos(2t - \pi/4)$



a) ODE for $v(t)$, $t>0$
b) v_p and v_h
c) $i(t) = i_p(t) + v_{ss}(t)$ for $t>0$
d) $i_c(t)$?

a) $f(t) = 2\cos(2t - \pi/4) = 2\cos(2t)\cos(-\pi/4) - 2\sin(2t)\sin(-\pi/4)$

$\cos(2t) + \frac{2\sqrt{2}}{2}\sin(2t)$

KCL @ A: $\frac{f(t) - V_A}{2\Omega} = i(t) + \frac{V_A}{2\Omega} \rightarrow \frac{1}{2}f(t) = i(t) - \frac{1}{2}v(t) = 2i(t) + \frac{1}{2}v(t)$

$\hookrightarrow \frac{1}{2}f(t) = 3\frac{dv}{dt} + v(t) \rightarrow$ $\boxed{\frac{dv}{dt} = \frac{1}{6}f(t) - \frac{1}{3}v(t)}$

$\boxed{V_A = 2i(t) + v(t)}$

b) $r + \frac{1}{3} = 0$; $r = -\frac{1}{3}$

$\hookrightarrow v_h(t) = Ce^{-t/3}$

Guess: $v_p(t) = A\cos(2t) + B\sin(2t)$

$\hookrightarrow v' = -2A\sin(2t) + 2B\cos(2t)$

$-2A\sin(2t) + 2B\cos(2t) + \frac{1}{3}(A\cos(2t) + B\sin(2t))$

$\hookrightarrow \frac{\sqrt{2}}{6}(\cos(2t) + \sin(2t))$

$\hookrightarrow \frac{1}{3}A + 2B = \frac{\sqrt{2}}{6}$
$\frac{1}{3}B - 2B = \frac{\sqrt{2}}{6}$
$\Big\} \frac{A = \frac{-5\sqrt{2}}{74}}{B = \frac{7\sqrt{2}}{74}}$

$\hookrightarrow v(t) = Ce^{-t} - A\cos(2t) + B\sin(2t)$

$\hookrightarrow C = \frac{148 + 5\sqrt{2}}{74}$

$\hookrightarrow$ $\boxed{v_p(t) = \frac{-5\sqrt{2}}{74}\cos(2t) + \frac{7\sqrt{2}}{74}\sin(2t) \text{ Volts}}$

$\boxed{v_h(t) = \frac{148 + 5\sqrt{2}}{74}e^{-t/3} \text{ Volts}}$

$2B + \frac{A}{3} = \frac{1}{3\sqrt{2}}$

$\frac{B}{3} - 2A = \frac{1}{3\sqrt{2}}$

3.1 5 / 5

✓ **- 0 pts** **Correct: $$\frac{dv}{dt} + \frac1 3 v(t) = \frac 1 3 \cos(2t-\frac\pi 4) = \frac 1 6 f(t) $$**

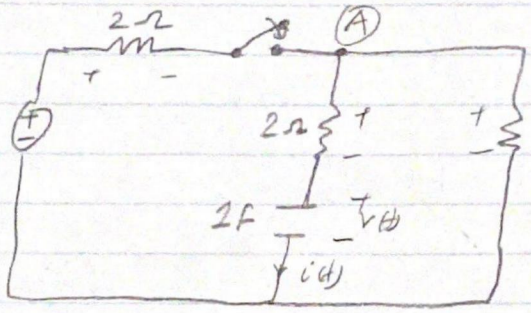
- 2 pts Minor Mistake

- 4 pts Incorrect

- 5 pts Cannot find solution

- 0 pts (Please feel free to submit a regrade request)

3. Switch closed at $t=0$, $v(0^-) = 2V$, $f(t) = 2\cos(2t - \pi/4)$



a) ODE for $v(t)$, $t>0$
b) v_p and v_h
c) $i(t) = i_p(t) + v_{ss}(t)$ for $t>0$
d) $i_c(t)$?

a) $f(t) = 2\cos(2t - \pi/4) = 2\cos(2t)\cos(-\pi/4) - 2\sin(2t)\sin(-\pi/4)$

$\cos(2t) + \frac{2\sqrt{2}}{2}\sin(2t)$

KCL @ A: $\frac{f(t) - V_A}{2\Omega} = i(t) + \frac{V_A}{2\Omega} \rightarrow \frac{1}{2}f(t) = i(t) - \frac{1}{2}v(t) = 2i(t) + \frac{1}{2}v(t)$

$\hookrightarrow \frac{1}{2}f(t) = 3\frac{dv}{dt} + v(t) \rightarrow$ $\boxed{\frac{dv}{dt} = \frac{1}{6}f(t) - \frac{1}{3}v(t)}$

$\boxed{V_A = 2i(t) + v(t)}$

b) $r + \frac{1}{3} = 0$; $r = -\frac{1}{3}$

$\hookrightarrow v_h(t) = Ce^{-t/3}$

Guess: $v_p(t) = A\cos(2t) + B\sin(2t)$

$\hookrightarrow v' = -2A\sin(2t) + 2B\cos(2t)$

$-2A\sin(2t) + 2B\cos(2t) + \frac{1}{3}(A\cos(2t) + B\sin(2t))$

$\hookrightarrow \frac{\sqrt{2}}{6}(\cos(2t) + \sin(2t))$

$\hookrightarrow \frac{1}{3}A + 2B = \frac{\sqrt{2}}{6}$
$\frac{1}{3}B - 2B = \frac{\sqrt{2}}{6}$
$\Big\} \frac{A = \frac{-5\sqrt{2}}{74}}{B = \frac{7\sqrt{2}}{74}}$

$\hookrightarrow v(t) = Ce^{-t} - A\cos(2t) + B\sin(2t)$

$\hookrightarrow C = \frac{148 + 5\sqrt{2}}{74}$

$\hookrightarrow$ $\boxed{v_p(t) = \frac{-5\sqrt{2}}{74}\cos(2t) + \frac{7\sqrt{2}}{74}\sin(2t) \text{ Volts}}$

$\boxed{v_h(t) = \frac{148 + 5\sqrt{2}}{74}e^{-t/3} \text{ Volts}}$

$2B + \frac{A}{3} = \frac{1}{3\sqrt{2}}$

$\frac{B}{3} - 2A = \frac{1}{3\sqrt{2}}$

3.2 5 / 5

✓ **- 0 pts** **Correct**

- 2.5 pts No/Incorrect $$v_p$$

- 2.5 pts No/Incorrect $$v_h$$

- 2.5 pts partial.

- 3 pts partial. calculation error in both equations

- 1 pts incorrect sign in equation.

- 1.5 pts calculation error in one equation

4)

3) $v(t) = \underbrace{A\cos(2t) + B\sin(2t)}_{V_{SS}(t)} + \underbrace{Ce^{-t/3}}_{V_{TR}(t)}$

$$v(t) = \frac{\sqrt{2}}{74}\left(7\sin(2t) - 5\cos(2t)\right) + \frac{148+5\sqrt{2}}{74} e^{-t/3} \text{ Volts}$$

d) $A' = -2B \rightarrow 2 \cdot \frac{7\sqrt{2}}{74} = \frac{7\sqrt{2}}{37}$

$B' = -2A \rightarrow -2 \cdot \frac{5\sqrt{2}}{74} = \frac{5\sqrt{2}}{37}$

$\hookrightarrow i(t) = A'\cos(2t) + B'\sin(2t) - 3 \cdot Ce^{-t/3}$

$$\hookrightarrow i(t) = \frac{7\sqrt{2}}{37}\cos(2t) + \frac{5\sqrt{2}}{37}\sin(2t) - 3\left(\frac{148+5\sqrt{2}}{74}\right)e^{-t/3} \text{ Amps}$$

3.3 5 / 5

✓ **- 0 pts** **Correct**

- 2.5 pts Incorrect Transient Signal $$v_{tr}(t) = \frac{148+5\sqrt{2}}{74}e^{-\frac{t}{3}}$$

- 2.5 pts Incorrect Steady-State Signal $$v_{SS}(t) = -\frac{5\sqrt{2}}{74}cos(2t) + \frac{7\sqrt{2}}{74}sin(2t)$$

+ 3 pts Correct process, but both parts incorrect due to errors in previous parts

+ 1.5 pts Correct process, but one part incorrect due to errors in previous parts

- 1 pts polarity issues

- 5 pts No signature

4)

3) $v(t) = \underbrace{A\cos(2t) + B\sin(2t)}_{V_{SS}(t)} + \underbrace{Ce^{-t/3}}_{V_{TR}(t)}$

$$v(t) = \frac{\sqrt{2}}{74}\left(7\sin(2t) - 5\cos(2t)\right) + \frac{148+5\sqrt{2}}{74} e^{-t/3} \text{ Volts}$$

d) $A' = -2B \rightarrow 2 \cdot \frac{7\sqrt{2}}{74} = \frac{7\sqrt{2}}{37}$

$B' = -2A \rightarrow -2 \cdot \frac{5\sqrt{2}}{74} = \frac{5\sqrt{2}}{37}$

$\hookrightarrow i(t) = A'\cos(2t) + B'\sin(2t) - 3 \cdot Ce^{-t/3}$

$$\hookrightarrow i(t) = \frac{7\sqrt{2}}{37}\cos(2t) + \frac{5\sqrt{2}}{37}\sin(2t) - 3\left(\frac{148+5\sqrt{2}}{74}\right)e^{-t/3} \text{ Amps}$$

3.4 **4 / 5**

- **0 pts** Correct
- **3 pts** Refer to answer key.
- **5 pts** Missing / Incorrect answer.
- **1 pts** Page not assigned.
- **2 pts** Error propagating from previous answer.
- **2 pts** Incorrect Coefficient(s).

✓ **- 1 pts** **Incorrect coefficient for exponent term**

- **0.5 pts** Partially incorrect coefficient for exponent term

$f(t) = A\cos(\omega t + \theta) = Re\{Ae^{j(\omega t+\theta)}\} = Re\{Ae^{j\theta}e^{j\omega t}\} = Re\{Fe^{j\omega t}\}$

5

4. a) $f(t) = \cos(6t + 4\pi/3)$ → co-sinusoidal → phasor

$F = 1e^{j4\pi/3}$

b) $f(t) = 12\sin(\omega t + \pi/2) \rightarrow f(t) = 12\cos(\omega t)$

↳ $F = 12e^{j0} = \boxed{12 = F}$

c) $f(t) = -12\sin(2\pi t) \rightarrow f(t) = -12\cos(2\pi t - \pi/2)$

↳ $f(t) = 12\cos(2\pi t - \pi/2 + \pi) = 12\cos(2\pi t + \pi/2) = f(t)$

↳ $F = 12e^{j\pi/2} \rightarrow \boxed{F = 12j}$

5. $\omega = 4$ rad/s

a) $F = -j4 \rightarrow 4e^{j-\pi/2} = 4\cos(\omega t - \pi/2) = \boxed{4\cos(4t - \pi/2) = f(t)}$

b) $F = 2e^{-j\cdot\pi/6} \rightarrow 2\cos(\omega t - \pi/6) \Rightarrow \boxed{2\cos(4t - \pi/6) = f(t)}$

c) $F = -j4 + 2e^{-j\pi/6}$

↳ $4e^{-j\pi/2} + 2e^{-j\pi/6}$

↓

$4\cos(4t - \pi/2) + 2\cos(4t - \pi/6)$

phasor → co-sinusoidal

→

4.1 3 / 3

✓ **- 0 pts** **Correct**

- 0.3 pts No/Incorrect Page Assignment

- 3 pts Incorrect

- 1.5 pts Incorrect Coefficient

- 1.5 pts Incorrect angle

$f(t) = A\cos(\omega t + \theta) = Re\{Ae^{j(\omega t+\theta)}\} = Re\{Ae^{j\theta}e^{j\omega t}\} = Re\{Fe^{j\omega t}\}$

5

4. a) $f(t) = \cos(6t + 4\pi/3)$ → co-sinusoidal → phasor

$F = 1e^{j4\pi/3}$

b) $f(t) = 12\sin(\omega t + \pi/2) \rightarrow f(t) = 12\cos(\omega t)$

↳ $F = 12e^{j0} = \boxed{12 = F}$

c) $f(t) = -12\sin(2\pi t) \rightarrow f(t) = -12\cos(2\pi t - \pi/2)$

↳ $f(t) = 12\cos(2\pi t - \pi/2 + \pi) = 12\cos(2\pi t + \pi/2) = f(t)$

↳ $F = 12e^{j\pi/2} \rightarrow \boxed{F = 12j}$

5. $\omega = 4$ rad/s

a) $F = -j4 \rightarrow 4e^{j-\pi/2} = 4\cos(\omega t - \pi/2) = \boxed{4\cos(4t - \pi/2) = f(t)}$

b) $F = 2e^{-j\cdot\pi/6} \rightarrow 2\cos(\omega t - \pi/6) \Rightarrow \boxed{2\cos(4t - \pi/6) = f(t)}$

c) $F = -j4 + 2e^{-j\pi/6}$

↳ $4e^{-j\pi/2} + 2e^{-j\pi/6}$

↓

$4\cos(4t - \pi/2) + 2\cos(4t - \pi/6)$

phasor → co-sinusoidal

→

4.2 3 / 3

✓ **- 0 pts** **Correct**

- 1 pts Incorrect phase

- 0.5 pts Did not simplify

- 0.5 pts Sign Error

- 3 pts Did not attempt

- 1 pts Incorrect magnitude

$f(t) = A\cos(\omega t + \theta) = Re\{Ae^{j(\omega t+\theta)}\} = Re\{Ae^{j\theta}e^{j\omega t}\} = Re\{Fe^{j\omega t}\}$

5

4. a) $f(t) = \cos(6t + 4\pi/3)$ → co-sinusoidal → phasor

$F = 1e^{j4\pi/3}$

b) $f(t) = 12\sin(\omega t + \pi/2) \rightarrow f(t) = 12\cos(\omega t)$

↳ $F = 12e^{j0} = \boxed{12 = F}$

c) $f(t) = -12\sin(2\pi t) \rightarrow f(t) = -12\cos(2\pi t - \pi/2)$

↳ $f(t) = 12\cos(2\pi t - \pi/2 + \pi) = 12\cos(2\pi t + \pi/2) = f(t)$

↳ $F = 12e^{j\pi/2} \rightarrow \boxed{F = 12j}$

5. $\omega = 4$ rad/s

a) $F = -j4 \rightarrow 4e^{j-\pi/2} = 4\cos(\omega t - \pi/2) = \boxed{4\cos(4t - \pi/2) = f(t)}$

b) $F = 2e^{-j\cdot\pi/6} \rightarrow 2\cos(\omega t - \pi/6) \Rightarrow \boxed{2\cos(4t - \pi/6) = f(t)}$

c) $F = -j4 + 2e^{-j\pi/6}$

↳ $4e^{-j\pi/2} + 2e^{-j\pi/6}$

↓

$4\cos(4t - \pi/2) + 2\cos(4t - \pi/6)$

phasor → co-sinusoidal

→

4.3 3 / 3

✓ **- 0 pts** **Correct**

- 1 pts Wrong coefficient or sign

- 1 pts Wrong imaginary part

- 3 pts Wrong or Blank

- 1 pts Partial credit for reasonable trying

16

5c) $f = -j4 + 2e^{-\pi/6} \Rightarrow 4\cos(4t - \pi/2) + 2\cos(4t - \pi/6)$

$A\cos(\omega t + \alpha) + B\cos(\omega t + \beta)$

↳ $\sqrt{[A\cos(\alpha) + B\cos(\beta)]^2 + [A\sin(\alpha) + B\sin(\beta)]^2}$

↳ $\cos\left(\omega t + \tan^{-1}\left[\frac{A\sin(\alpha) + B\sin(\beta)}{A\cos(\alpha) + B\cos(\beta)}\right]\right)$

↳ exp → rect: $re^{j\theta} \rightarrow x = r\cos\theta$, $y = r\sin\theta$ → $x + jy$

↳ rect → exp: $x + jy \rightarrow \|A\| = \sqrt{x^2 + y^2}$, $\phi = \tan^{-1}\left(\frac{y}{x}\right)$ → $\|A\|e^{j\phi}$

↳ $f = -j4 + 2e^{-\pi/6 j} = -j4 + 2\cos\left(\frac{\pi}{6}\right) + 2\sin\left(-\frac{\pi}{6}\right)$

$= -4j - j2\left(\frac{1}{2}\right) + 2\left(\frac{\sqrt{3}}{2}\right) = \sqrt{3} - 5j$

↳ $\|A\| = \sqrt{(\sqrt{3})^2 + (-5)^2} = \sqrt{3 + 25} = \sqrt{28} = 2\sqrt{7}$ $-5\sqrt{3}$

↳ $\phi = \arctan\left(\frac{-5}{\sqrt{3}}\right)$

↳ $\boxed{f(t) = 2\sqrt{7}\left(\cos 4t + \arctan\left(\frac{-5}{\sqrt{3}}\right)\right)}$

5.1 **3 / 3**

✓ **- 0 pts** **Correct**

- 3 pts Incorrect or no submission

- 1.5 pts Minor error (phase error, amplitude error)

16

5c) $f = -j4 + 2e^{-\pi/6} \Rightarrow 4\cos(4t - \pi/2) + 2\cos(4t - \pi/6)$

$A\cos(\omega t + \alpha) + B\cos(\omega t + \beta)$

↳ $\sqrt{[A\cos(\alpha) + B\cos(\beta)]^2 + [A\sin(\alpha) + B\sin(\beta)]^2}$

↳ $\cos\left(\omega t + \tan^{-1}\left[\frac{A\sin(\alpha) + B\sin(\beta)}{A\cos(\alpha) + B\cos(\beta)}\right]\right)$

↳ exp → rect: $re^{j\theta} \rightarrow x = r\cos\theta$, $y = r\sin\theta$ → $x + jy$

↳ rect → exp: $x + jy \rightarrow \|A\| = \sqrt{x^2 + y^2}$, $\phi = \tan^{-1}\left(\frac{y}{x}\right)$ → $\|A\|e^{j\phi}$

↳ $f = -j4 + 2e^{-\pi/6 j} = -j4 + 2\cos\left(\frac{\pi}{6}\right) + 2\sin\left(-\frac{\pi}{6}\right)$

$= -4j - j2\left(\frac{1}{2}\right) + 2\left(\frac{\sqrt{3}}{2}\right) = \sqrt{3} - 5j$

↳ $\|A\| = \sqrt{(\sqrt{3})^2 + (-5)^2} = \sqrt{3 + 25} = \sqrt{28} = 2\sqrt{7}$ $-5\sqrt{3}$

↳ $\phi = \arctan\left(\frac{-5}{\sqrt{3}}\right)$

↳ $\boxed{f(t) = 2\sqrt{7}\left(\cos 4t + \arctan\left(\frac{-5}{\sqrt{3}}\right)\right)}$

5.2 3 / 3

✓ **- 0 pts** **Correct**

- 1 pts Incorrect angular frequency

- 1.5 pts Incorrect magnitude

- 1.5 pts Incorrect phase

- 3 pts Incorrect magnitude and phase

- 3 pts No submission

16

5c) $f = -j4 + 2e^{-\pi/6} \Rightarrow 4\cos(4t - \pi/2) + 2\cos(4t - \pi/6)$

$A\cos(\omega t + \alpha) + B\cos(\omega t + \beta)$

↳ $\sqrt{[A\cos(\alpha) + B\cos(\beta)]^2 + [A\sin(\alpha) + B\sin(\beta)]^2}$

↳ $\cos\left(\omega t + \tan^{-1}\left[\frac{A\sin(\alpha) + B\sin(\beta)}{A\cos(\alpha) + B\cos(\beta)}\right]\right)$

↳ exp → rect: $re^{j\theta} \rightarrow x = r\cos\theta$, $y = r\sin\theta$ → $x + jy$

↳ rect → exp: $x + jy \rightarrow \|A\| = \sqrt{x^2 + y^2}$, $\phi = \tan^{-1}\left(\frac{y}{x}\right)$ → $\|A\|e^{j\phi}$

↳ $f = -j4 + 2e^{-\pi/6 j} = -j4 + 2\cos\left(\frac{\pi}{6}\right) + 2\sin\left(-\frac{\pi}{6}\right)$

$= -4j - j2\left(\frac{1}{2}\right) + 2\left(\frac{\sqrt{3}}{2}\right) = \sqrt{3} - 5j$

↳ $\|A\| = \sqrt{(\sqrt{3})^2 + (-5)^2} = \sqrt{3 + 25} = \sqrt{28} = 2\sqrt{7}$ $-5\sqrt{3}$

↳ $\phi = \arctan\left(\frac{-5}{\sqrt{3}}\right)$

↳ $\boxed{f(t) = 2\sqrt{7}\left(\cos 4t + \arctan\left(\frac{-5}{\sqrt{3}}\right)\right)}$

5.3 3 / 3

✓ **- 0 pts** **Correct**

- 3 pts incorrect

- 0.5 pts no page selected / wrong page selected

- 3 pts didn't express in one cosine function (otherwise there's no point in completing part c after doing part a and part b)

- 0.5 pts blurry image

- 1 pts didn't simplify