

# Solution of EECS 315 Test 10 F13

1. Fill in the blanks with correct numbers.

(a)  $22 \operatorname{rect}\left(\frac{t-3}{11}\right) \xleftrightarrow{\mathcal{F}} A \operatorname{sinc}(af) e^{bf}$   $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$22 \operatorname{rect}\left(\frac{t-3}{11}\right) \xleftrightarrow{\mathcal{F}} 242 \operatorname{sinc}(11f) e^{-j6\pi f} \Rightarrow A = 242$  ,  $a = 11$  ,  $b = -j6\pi$

(b)

$-8 \cos(42\pi(t-0.02)) \xleftrightarrow{\mathcal{F}} A [\delta(f-a)e^b + \delta(f+a)e^{-b}]$  ,  $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$-8 \cos(42\pi(t-0.02)) \xleftrightarrow{\mathcal{F}} -4 [\delta(f-21) + \delta(f+21)] e^{-j0.04\pi f} = -4 [\delta(f-21) e^{-j2.63} + \delta(f+21) e^{j2.63}]$   
 $A = -4$  ,  $a = 21$  ,  $b = -j2.63$

(c)

$A \operatorname{sinc}^2(t/a) \delta_b(t) \xleftrightarrow{\mathcal{F}} 15 \operatorname{tri}(18f) * \delta_{1/2}(f)$  ,  $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$(30/18) \operatorname{sinc}^2(t/18) \delta_2(t) \xleftrightarrow{\mathcal{F}} 15 \operatorname{tri}(18f) * \delta_{1/2}(f)$  ,  $A = 5/3 = 1.667 =$  ,  $a = 18$  ,  $b = 2$

2. Find the numerical value of the integral  $I = \int_{-\infty}^{\infty} 13 \operatorname{sinc}^2(25t) dt$  .  $I = \underline{\hspace{2cm}}$

$$I = \int_{-\infty}^{\infty} 13 \operatorname{sinc}^2(25t) dt = \mathcal{F} (13 \operatorname{sinc}^2(25t)) \Big|_{f=0} = (13/25) \operatorname{tri}(f/25) \Big|_{f=0} = 13/25 = 0.52$$

3. Find the numerical signal energy of  $x(t) = 28 \operatorname{sinc}(t/15)$  .  $\text{Signal Energy} = \underline{\hspace{2cm}}$

$$E_x = \int_{-\infty}^{\infty} |x(t)|^2 dt = \int_{-\infty}^{\infty} |X(f)|^2 df = \int_{-\infty}^{\infty} |28 \times 15 \operatorname{rect}(15f)|^2 df = 176400 \int_{-1/30}^{1/30} \operatorname{rect}(15f) df = 11760$$

# Solution of EECS 315 Test 10 F13

1. Fill in the blanks with correct numbers.

(a)  $17 \operatorname{rect}\left(\frac{t-2}{9}\right) \xrightarrow{\mathcal{F}} A \operatorname{sinc}(af) e^{bf}$   $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$17 \operatorname{rect}\left(\frac{t-2}{9}\right) \xrightarrow{\mathcal{F}} 153 \operatorname{sinc}(9f) e^{-j4\pi f} \Rightarrow A = 153$  ,  $a = 9$  ,  $b = -j4\pi$

(b)

$-14 \cos(68\pi(t-0.02)) \xrightarrow{\mathcal{F}} A [\delta(f-a)e^b + \delta(f+a)e^{-b}]$  ,  $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$-14 \cos(68\pi(t-0.02)) \xrightarrow{\mathcal{F}} -7 [\delta(f-34) + \delta(f+34)] e^{-j0.04\pi f} = -7 [\delta(f-34)e^{-j4.272} + \delta(f+34)e^{j4.272}]$   
 $A = -7$  ,  $a = 34$  ,  $b = -j4.272$

(c)

$A \operatorname{sinc}^2(t/a) \delta_b(t) \xrightarrow{\mathcal{F}} 24 \operatorname{tri}(11f) * \delta_{1/2}(f)$  ,  $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$(48/11) \operatorname{sinc}^2(t/11) \delta_2(t) \xrightarrow{\mathcal{F}} 24 \operatorname{tri}(11f) * \delta_{1/2}(f)$  ,  $A = 48/11 \cong 4.363$  ,  $a = 11$  ,  $b = 2$

2. Find the numerical value of the integral  $I = \int_{-\infty}^{\infty} 8 \operatorname{sinc}^2(32t) dt$  .  $I = \underline{\hspace{2cm}}$

$$I = \int_{-\infty}^{\infty} 8 \operatorname{sinc}^2(32t) dt = \mathcal{F} \left( 8 \operatorname{sinc}^2(32t) \right) \Big|_{f=0} = (8/32) \operatorname{tri}(f/32) \Big|_{f=0} = 1/4 = 0.25$$

3. Find the numerical signal energy of  $x(t) = 19 \operatorname{sinc}(t/5)$  .  $\text{Signal Energy} = \underline{\hspace{2cm}}$

$$E_x = \int_{-\infty}^{\infty} |x(t)|^2 dt = \int_{-\infty}^{\infty} |X(f)|^2 df = \int_{-\infty}^{\infty} |19 \times 5 \operatorname{rect}(5f)|^2 df = 9025 \int_{-1/10}^{1/10} \operatorname{rect}(5f) df = 1805$$

# Solution of EECS 315 Test 10 F13

1. Fill in the blanks with correct numbers.

(a)  $35 \operatorname{rect}\left(\frac{t-5}{9}\right) \xleftrightarrow{\mathcal{F}} A \operatorname{sinc}(af) e^{bf}$   $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$$35 \operatorname{rect}\left(\frac{t-5}{9}\right) \xleftrightarrow{\mathcal{F}} 315 \operatorname{sinc}(9f) e^{-j10\pi f} \Rightarrow A = 315 , a = 9 , b = -j10\pi$$

(b)

$-13 \cos(26\pi(t-0.03)) \xleftrightarrow{\mathcal{F}} A [\delta(f-a)e^{b} + \delta(f+a)e^{-b}]$  ,  $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$$-13 \cos(26\pi(t-0.03)) \xleftrightarrow{\mathcal{F}} -6.5 [\delta(f-13) + \delta(f+13)] e^{-j0.06\pi f} = -6.5 [\delta(f-13)e^{-j2.45} + \delta(f+13)e^{j2.45}]$$

$$A = -6.5 , a = 13 , b = -j2.45$$

(c)

$A \operatorname{sinc}^2(t/a) \delta_b(t) \xleftrightarrow{\mathcal{F}} 46 \operatorname{tri}(16f) * \delta_{1/2}(f)$  ,  $A = \underline{\hspace{2cm}}$  ,  $a = \underline{\hspace{2cm}}$  ,  $b = \underline{\hspace{2cm}}$

$$(92/16) \operatorname{sinc}^2(t/16) \delta_2(t) \xleftrightarrow{\mathcal{F}} 46 \operatorname{tri}(16f) * \delta_{1/2}(f) , A = 23/4 \cong 5.75 , a = 16 , b = 2$$

2. Find the numerical value of the integral  $I = \int_{-\infty}^{\infty} 27 \operatorname{sinc}^2(12t) dt$  .  $I = \underline{\hspace{2cm}}$

$$I = \int_{-\infty}^{\infty} 27 \operatorname{sinc}^2(12t) dt = \mathcal{F} (27 \operatorname{sinc}^2(12t)) \Big|_{f=0} = (27/12) \operatorname{tri}(f/12) \Big|_{f=0} = 27/12 = 2.25$$

3. Find the numerical signal energy of  $x(t) = 7 \operatorname{sinc}(t/25)$  . Signal Energy =  $\underline{\hspace{2cm}}$

$$E_x = \int_{-\infty}^{\infty} |x(t)|^2 dt = \int_{-\infty}^{\infty} |X(f)|^2 df = \int_{-\infty}^{\infty} |7 \times 25 \operatorname{rect}(25f)|^2 df = 30625 \int_{-1/50}^{1/50} \operatorname{rect}(25f) df = 1225$$