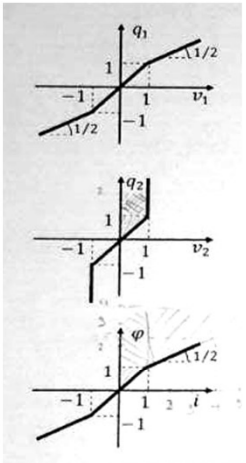
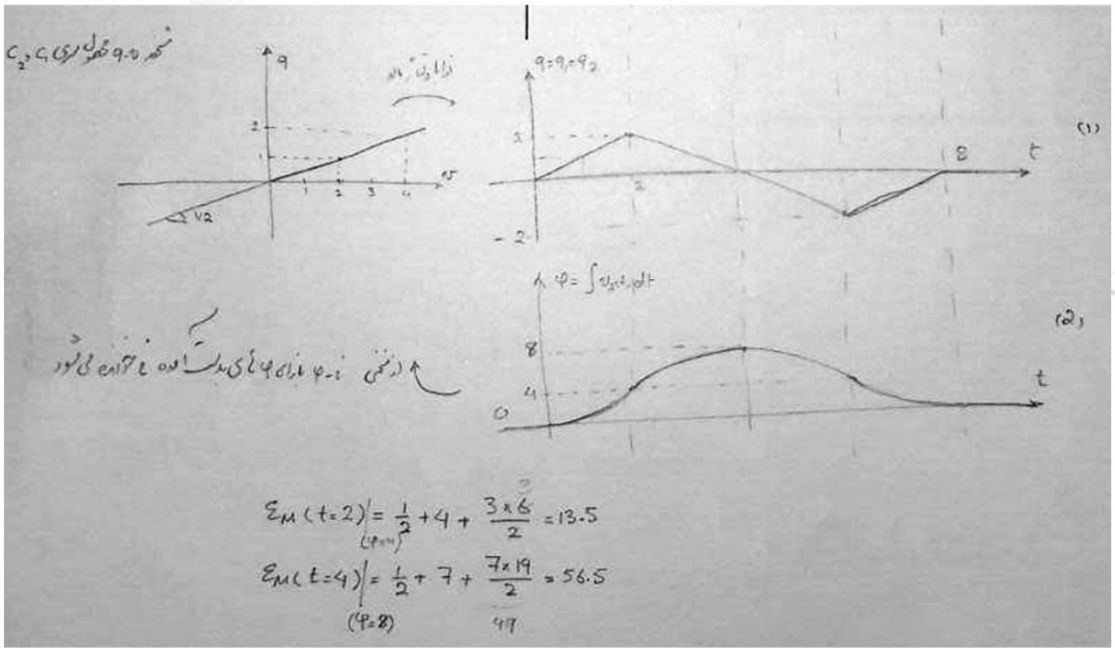
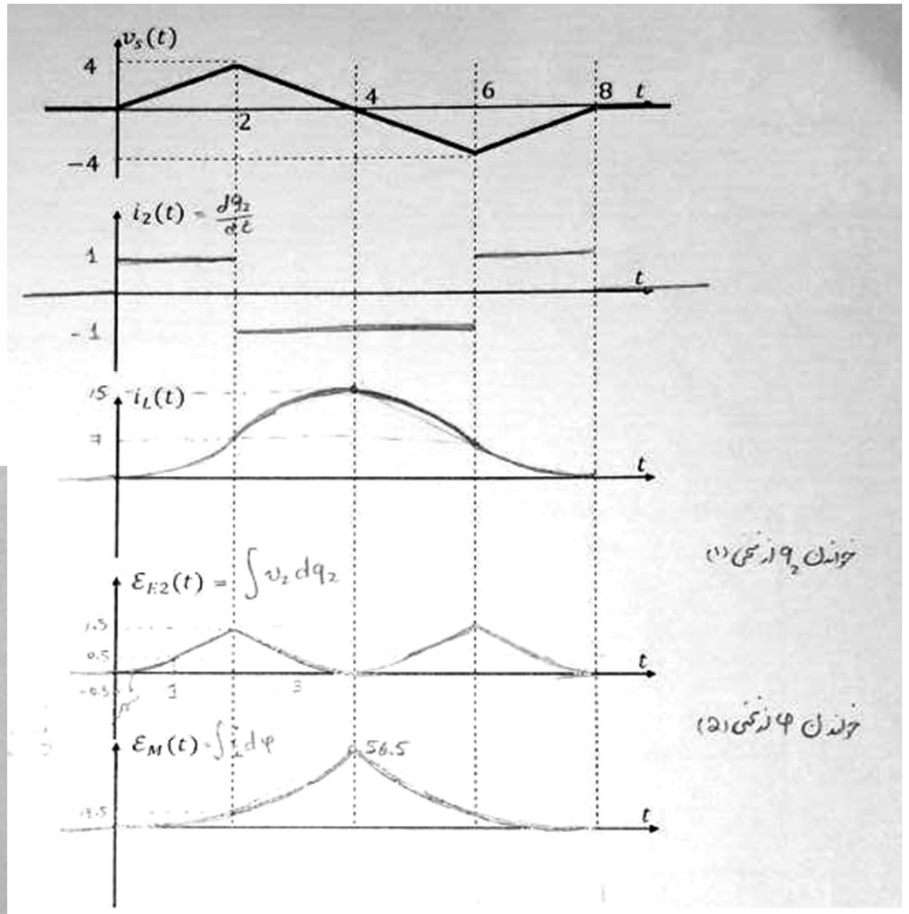
Part B

1.

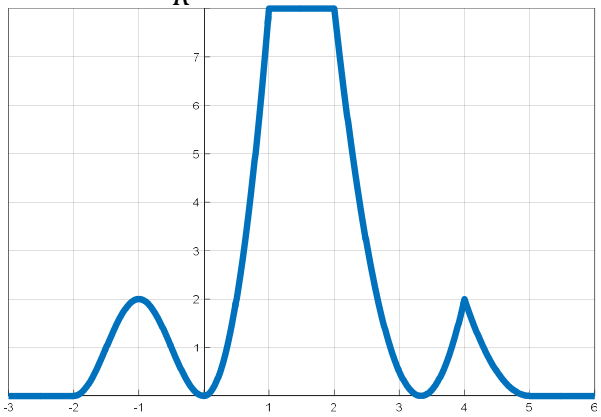

q_1
v_1
1/2
q_2
v_2
φ
i


q
v_2
$q=q_1=q_2$
t
(1)
$\varphi = \int v_2 dt$
(2)
$\mathcal{E}_M(t=2) = \frac{1}{2} + 4 + \frac{3\times 6}{2} = 13.5$
$\mathcal{E}_M(t=4) = \frac{1}{2} + 7 + \frac{7\times 19}{2} = 56.5$

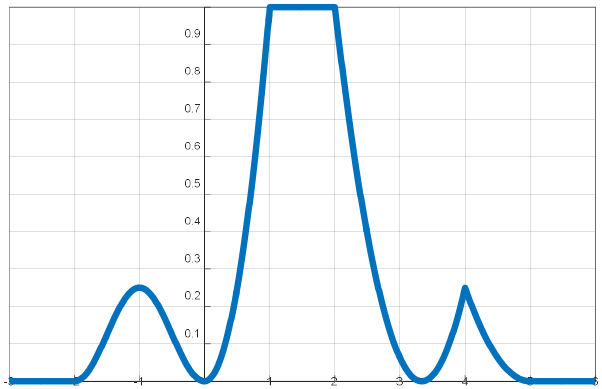

$v_s(t)$
$i_2(t) = \frac{dq_2}{dt}$
$i_L(t)$
$\mathcal{E}_{F2}(t) = \int v_2 dq_2$
$\mathcal{E}_M(t) = \int i_L d\varphi$
56.5
t
خروجی q_2 (۱)
خروجی φ (۲)

2

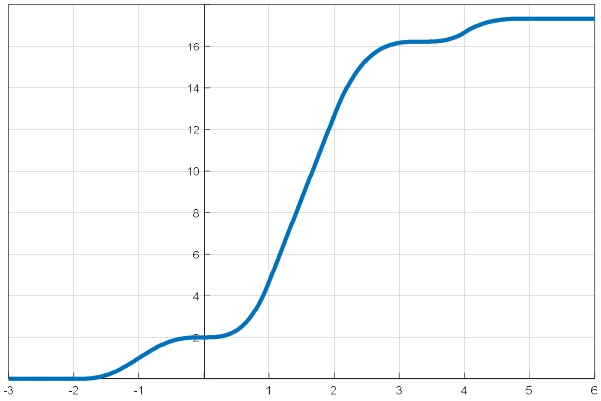
P_R



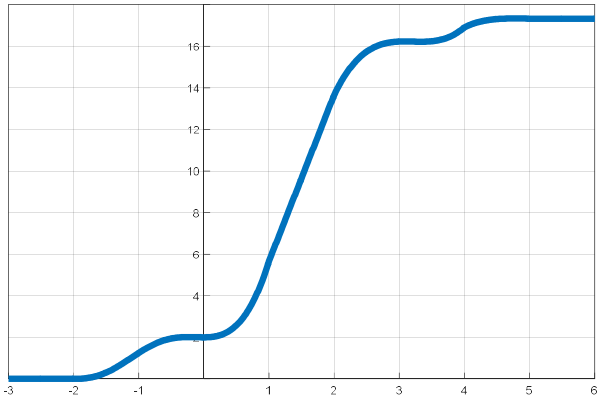
E_L



E_R



$E_L + E_R$

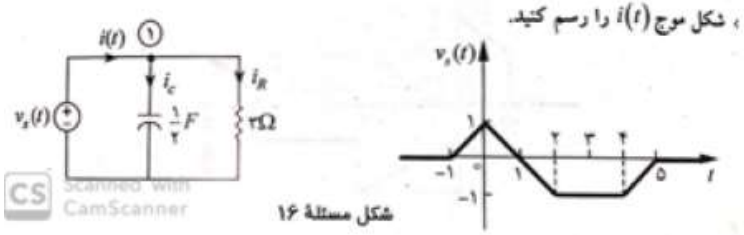


3

مشابه مساله ۶ قسمت الف

J16

، شکل موج $i(t)$ را رسم کنید.



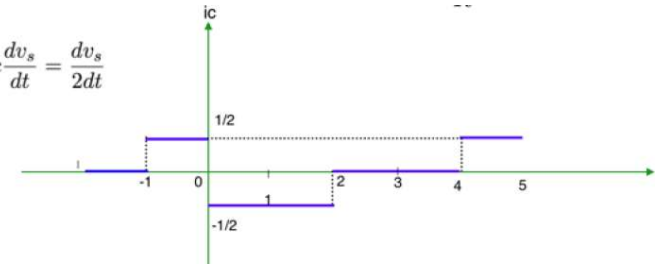
شکل مسئلهٔ ۱۶

$$KCL: i(t) = i_R + i_c$$

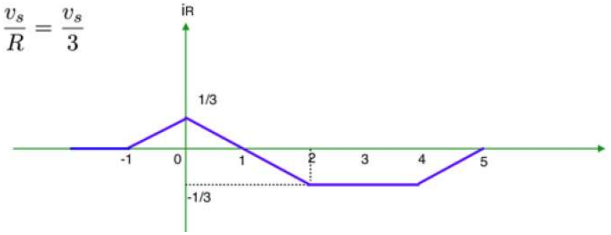
$$i_c = c\frac{dv_s}{dt}$$

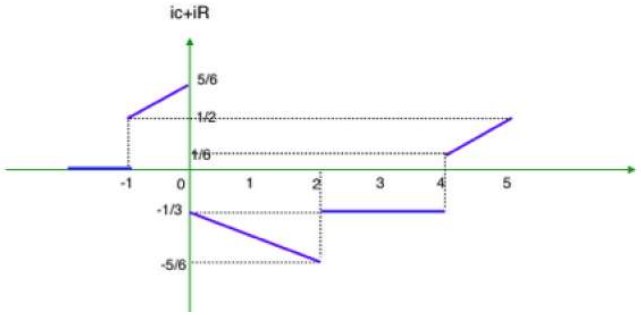
$$i_R = \frac{v_s}{R}$$

$$i_c = c\frac{dv_s}{dt} = \frac{dv_s}{2dt}$$



$$i_R = \frac{v_s}{R} = \frac{v_s}{3}$$



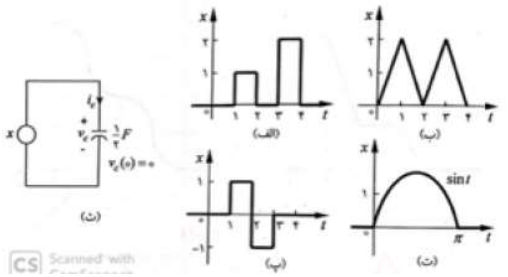


J22

◁ خازنی با $C=\frac{1}{2}F$ و $v_c(-)=0$ به دو سر منبع x وصل شده است.

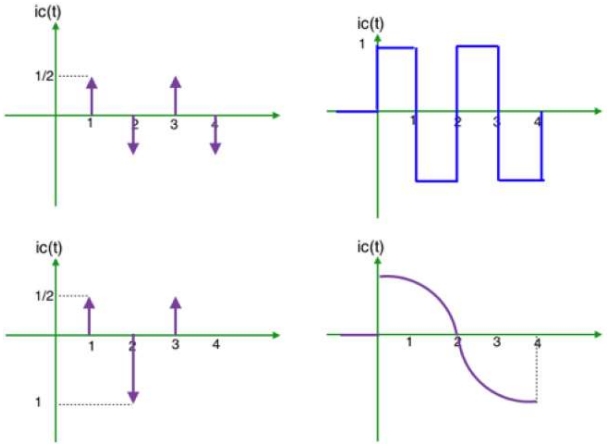
◁ الف) اگر منبع از نوع ولتاژ باشد، شکل موج جریان گذرنده از خازن را رسم کنید.

◁ ب) اگر منبع از نوع جریان باشد، شکل موج ولتاژ دو سر خازن را رسم کنید.



الف

$$i_c = c\frac{dv_c}{dt} = \frac{dv_c}{2dt}$$



ب

$i_c = c\frac{dv_c(t)}{dt}$ ← از دو طرف از t_0 تا t انتگرال می‌گیریم ← $\int_{t_0}^{t} i_c = \int_{t_0}^{t} c\frac{dv(t)}{dt} = c\,(v(t)-v(t_0))$

$$\rightarrow v(t) = \frac{1}{c}\int_{t_0}^{t} i_c(t) + v(t_0)$$

الف) $v(1)=0$ (جریان مثبت تا صفر بودن ثانیه برقرار است)

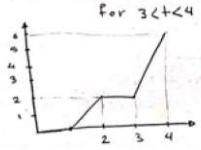
$v(2)=2$

$v(3)=2$

for $1<t<2$ → $v(t) = 2\int_1^t 1\,dt + 0 = 2(t-1)$

for $2<t<3$ → $v(t) = 2\times 0 + v(2) = 2$

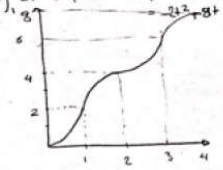
for $3<t<4$ → $v(t) = 2\int_3^t 2\,dt + 2 = 4(t-3)+2 = 4t-10$



ب) $v(0)=0$ → for $0<t<1$ → $i(t)=2t$ → $v(t) = 2\int_0^t 2t + 0 = 2t^2$

$v(1)=2$ → for $1<t<2$ → $i(t)=2(2-t)$ → $v(t) = 2\int_1^t 2(2-t)\,dt + 2 = 2\left(4(t-1) - \frac{t^2-1}{2}\right) + 2 = -2t^2+8t-4$

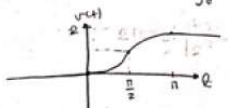
$v(2)=4$ ← وصل بهم مراحل با یکدیگر انتقال می‌کنیم



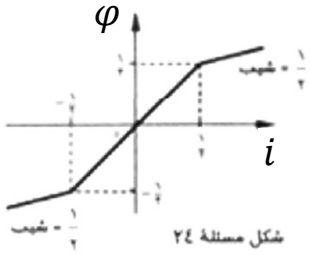
ج) $v(1)=0$ for $1<t<2$ → $v(t) = 2\int_1^t 1\,dt + 0 = 2(t-1)$

$v(2)=2$ for $2<t<3$ → $v(t) = 2\int_2^t -1\,dt + 2 = 2(2-t)+2 = 6-2t$

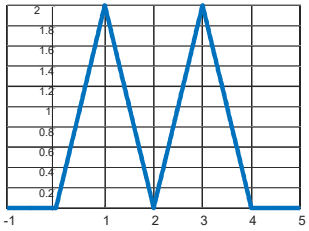
د) $v(0)=0$ for $0<t<\pi$ → $v(t) = 2\int_0^t \sin t\,dt + 0 = 2(1-\cos t)$



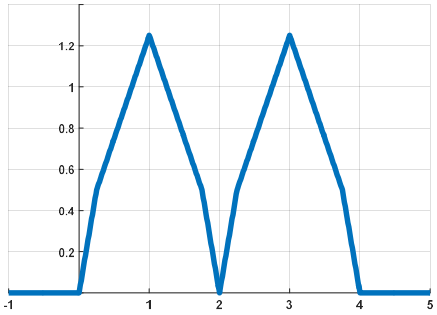
J25



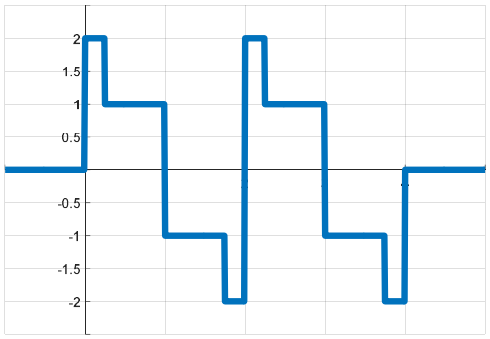
i_L



φ_L

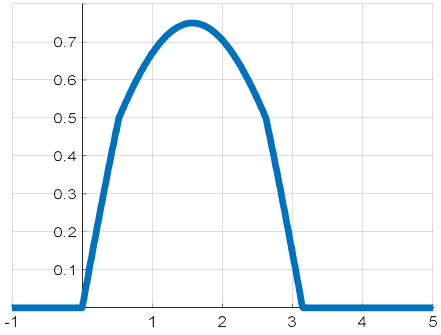


v_L

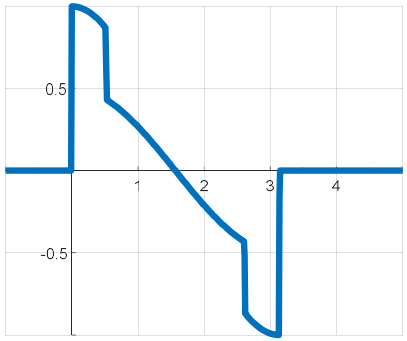


i_L

φ_L

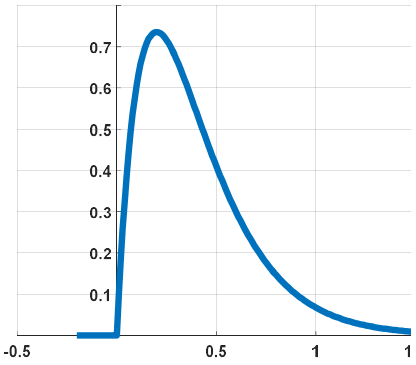


v_L

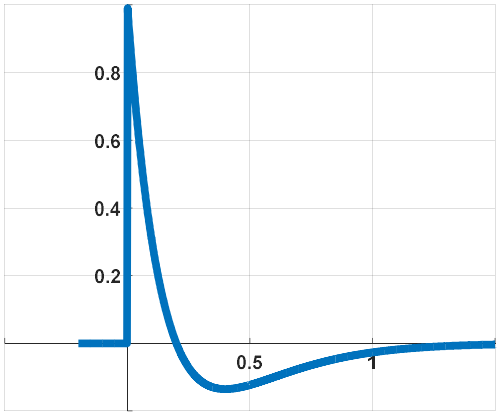


J27

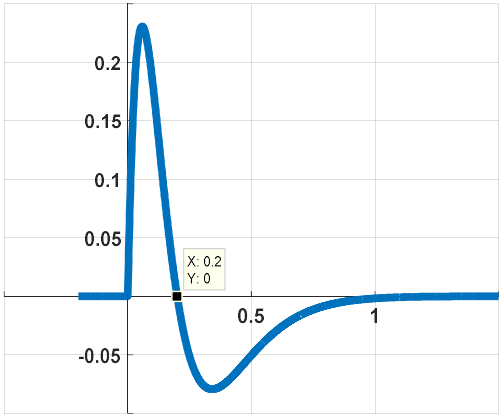
$$i(t) = 10te^{-5t}u(t)$$



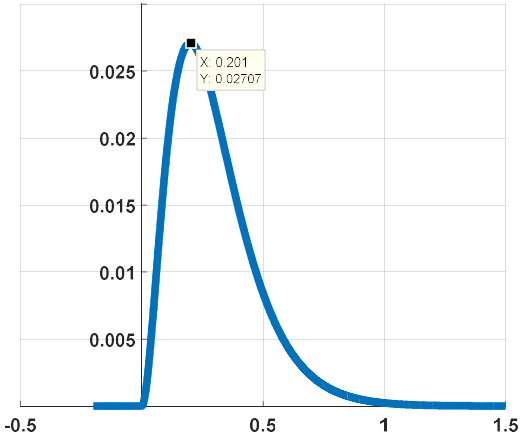
$$v_L(t) = 0.1\frac{di_l}{dt} = (1-5t)e^{-5t}u(t)$$



$$p(t) = v(t)i(t) = (10-50t)te^{-10t}u(t)$$



$$w(t) = \int p(t)dt = 5t^2e^{-10t}u(t)$$



$t < 0.2$: Energy stores

$t > 0.2$: Energy receives

$p(t = .2) = 0 \rightarrow$

$w_{max} = w(0.2) = 0.027\,J$