Q:

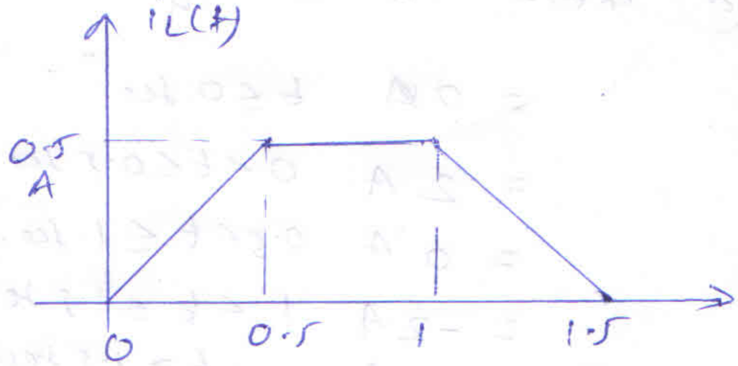
$i_L(t) = 0$ for $t \le 0$ sec.

$= t$ for $0 < t \le 0.5$ sec.

$= 0.5$ for $0.5 < t \le 1$ sec.

$= -t + 1.5$ for $1 < t \le 1.5$ sec.

$= 0$ for $t > 1.5$ sec



(a) $v(t) = L \frac{di_L(t)}{dt} = 8 \frac{di_L(t)}{dt}$

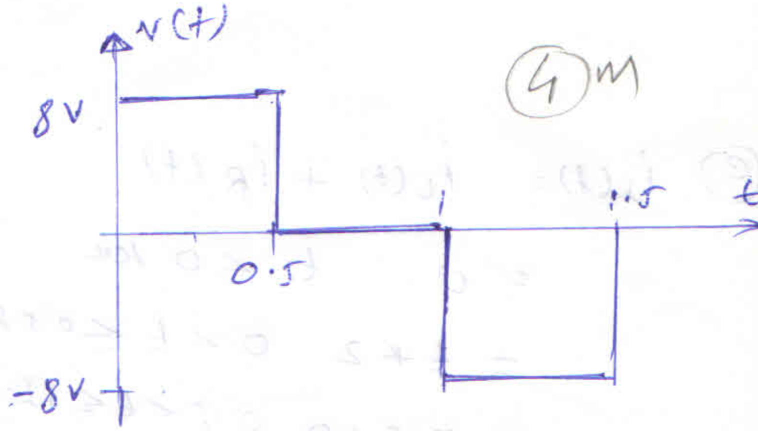
$= 0$ V $t \le 0$ sec.

$= 8$ V $0 < t \le 0.5$ sec.

$= 0$ V $0.5 < t \le 1$ sec.

$= -8$V $1 < t \le 1.5$ sec.

$= 0$ $t > 1.5$ sec.



4 M

(b) $W_L(t) = \frac{1}{2} L i_L^2 = 4 i_L^2$ J.

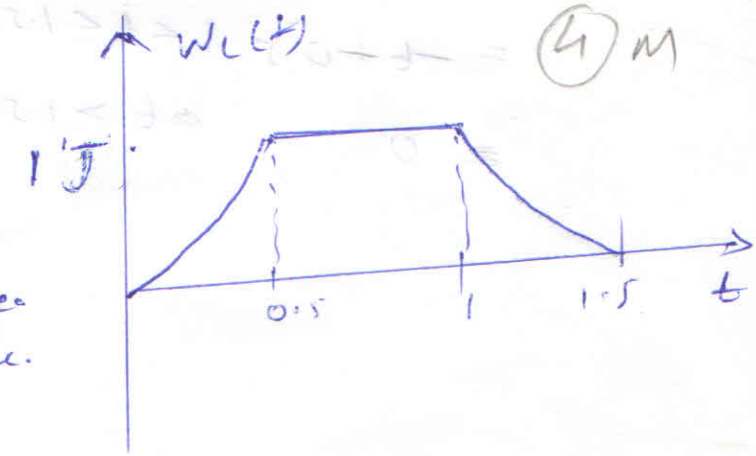
$= 0$ for $t \le 0$ sec.

$= 4t^2$ for $0 < t \le 0.5$ sec.

$= 1$ for $0.5 < t \le 1$ sec.

$= 4(-t + 1.5)^2$ for $1 < t \le 1.5$ sec

$= 0$ for $t > 1.5$ sec.



4 M

(c) $P_R(t) = v^2/R = v^2/4$

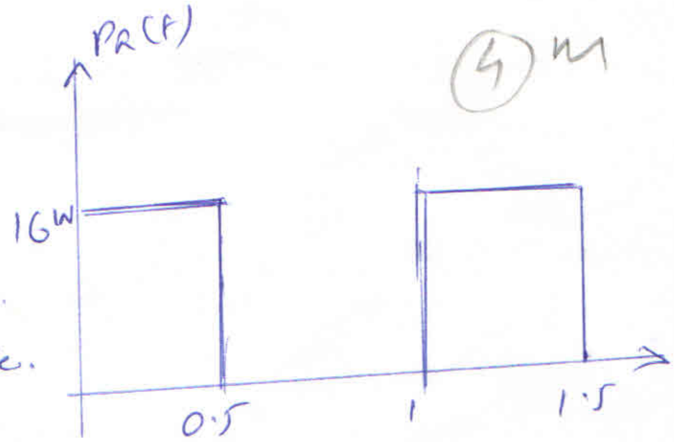
$= 0$ W for $t \le 0$ sec.

$= 16$ W for $0 < t \le 0.5$ sec

$= 0$ W for $0.5 < t \le 1$ sec.

$= 16$ W for $1 < t \le 1.5$ sec.

$= 0$ W for $t \ge 1.5$ sec.



4 M

ⓓ $i_R(t) = V/R = V/4$

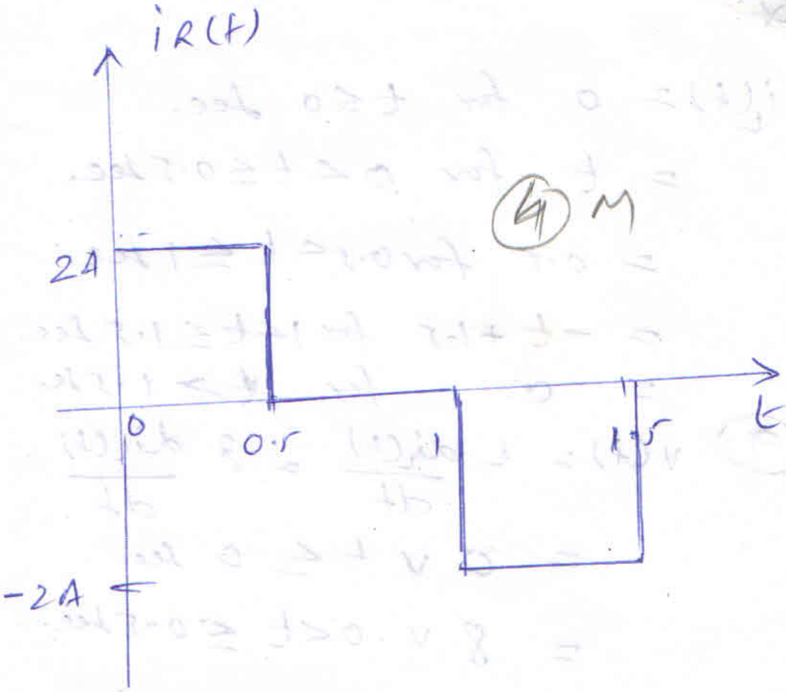
$= 0\,A \quad t \leq 0$ sec.

$= 2\,A \quad 0 < t \leq 0.5$ sec.

$= 0\,A \quad 0.5 < t \leq 1$ sec.

$= -2\,A \quad 1 < t \leq 1.5$ sec.

$= 0\,A \quad t > 1.5$ sec



④ M

ⓔ $i_s(t) = i_L(t) + i_R(t)$

$= 0 \quad t \leq 0$ sec

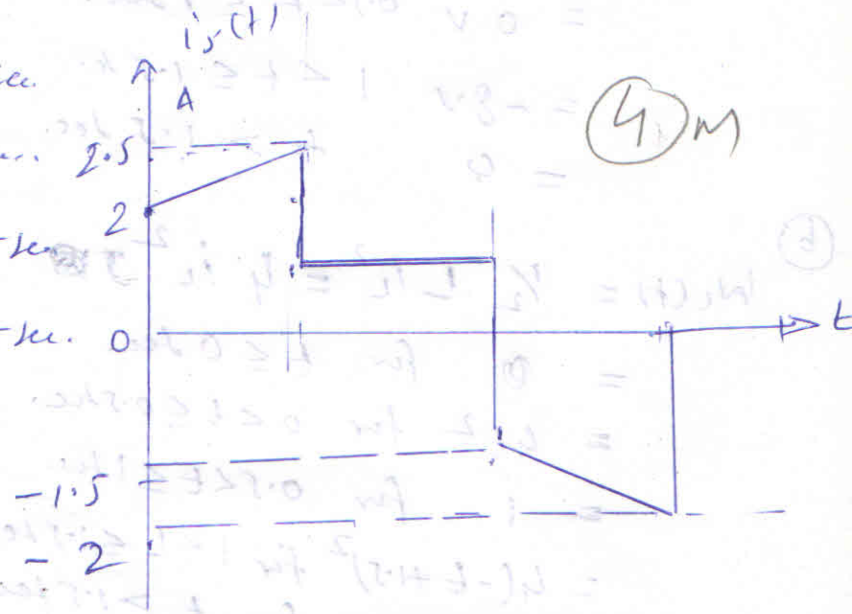
$= t + 2 \quad 0 < t \leq 0.5$ sec.

$= 0.5 + 0 \quad 0.5 < t \leq 1$ sec.

$= -t + 0.5 \quad 1 < t \leq 1.5$ sec

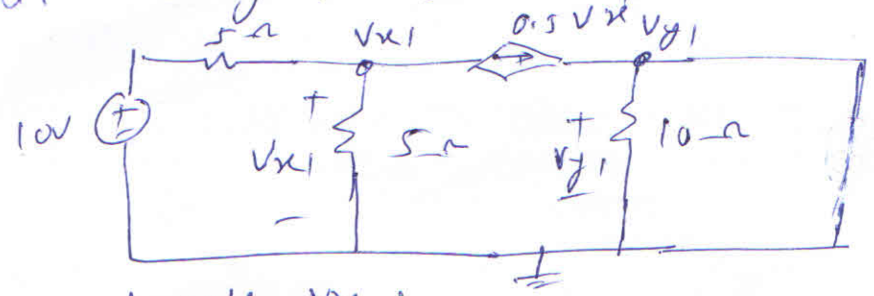
$t > 1.5$ sec.

$= 0$



④ M

Q: Assuming 10V source only.



at node Vx :

$$\frac{10 - V_{x1}}{5} = \frac{V_{x1}}{5} + 0.5 V_{x1}$$

$$2 - \frac{V_{x1}}{5} = \frac{V_{x1}}{5} + 0.5 V_{x1}$$

$$0.9 V_{x1} = 2$$

$$V_{x1} = 2/0.9 = 2.22 \text{ V} \quad — 1$$

3 M

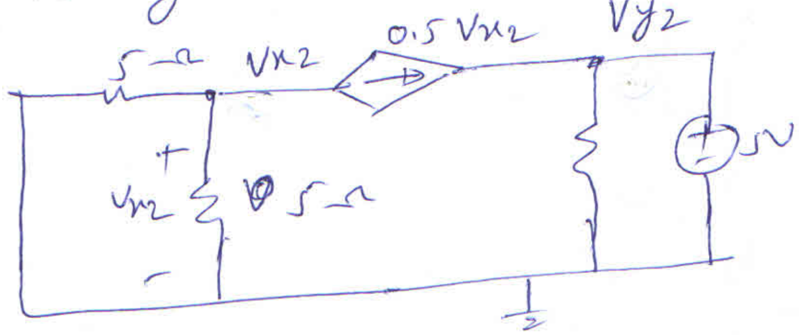
$$V_{y1} = 0 \quad — \quad 2$$

3 M

−ve sign indicate the power delivered by the dependent source.

1 M

Assuming 5V source only.



$$\frac{V_{x2}}{5} + \frac{V_{x2}}{5} + 0.5 V_{x2} = 0$$

$$\Rightarrow V_{x2} = 0$$ 3 M

& $V_{y2} = 5V$ 3 M

$$\therefore V_x = V_{x1} + V_{x2} = 2.22 + 0 = 2.22 \text{ V}$$ 1 M

$$V_y = V_{y1} + V_{y2} = 0 + 5 = 5V$$ 1 M

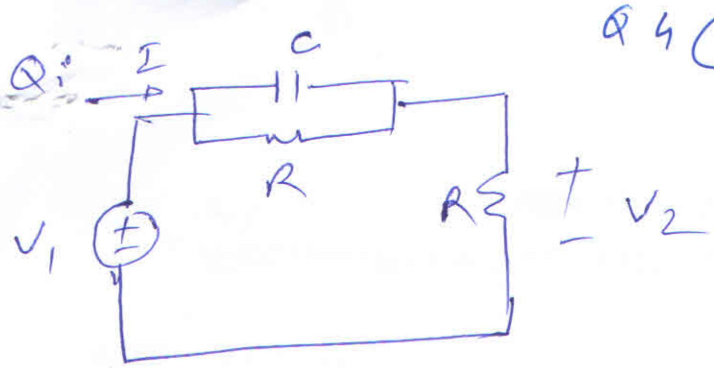
$$P_{dependent} = (V_x - V_y) \times 0.5 V_x$$ 5 M

$$= (2.22 - 5) \times 0.5 \times 2.22$$

$$= -3.0858 \text{ W}$$

Q 4 (A)

Q:



$$Z = \frac{R \times 1/j\omega C}{R + 1/j\omega C}$$

$$= \frac{R}{1 + j\omega RC}$$

$$V_2 = \frac{R}{R+Z} V_1$$

$$\frac{V_2}{V_1} = \frac{R}{R + \frac{R}{1+j\omega RC}} = \frac{1}{1 + \frac{1}{1+j\omega RC}}$$

$$= \frac{1 + j\omega RC}{2 + j\omega RC}$$

$\omega = 0$, $|V_2/V_1| = 1/2$

$\omega = \infty$, $|V_2/V_1| = 1$

$\omega = \omega_c$ $|V_2/V_1| = \frac{1}{\sqrt{2}}$

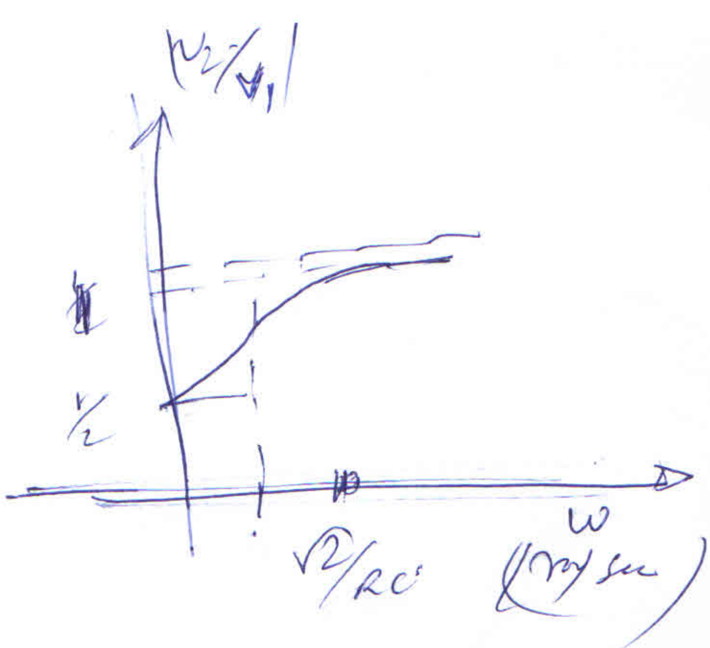
$$\frac{\sqrt{1 + \omega_c^2 R^2 C^2}}{\sqrt{4 + \omega_c^2 R^2 C^2}} = \frac{1}{\sqrt{2}}$$

$$2 + 2\omega_c^2 R^2 C^2 = 4 + \omega_c^2 R^2 C^2$$

$$\omega_c^2 R^2 C^2 = 2$$

$$\omega_c RC = \sqrt{2}$$

$$\therefore \boxed{\omega_c = \sqrt{2}/RC}$$

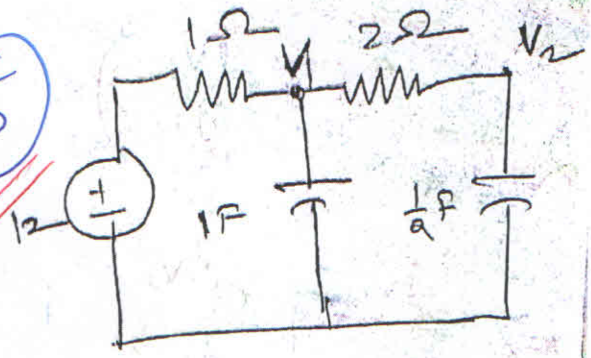


$t<0$

$v_1(t) = v_2(t) = 12\,V$

$\therefore v_1(0) = v_2(0) = 12\,V$

5



For $t \geq 0s$

KCL at node v_1,

$$\frac{v_1}{1} + \frac{dv_1}{dt} + \frac{v_1 - v_2}{2} = 0$$

$$\Rightarrow 2v_1 + 2\frac{dv_1}{dt} + v_1 - v_2 = 0$$

$$\Rightarrow 2\frac{dv_1}{dt} + 3v_1 - v_2 = 0 \quad \text{—— (1)}$$

3

KCL at node v_2,

$$\frac{v_2 - v_1}{2} + \frac{1}{2}\frac{dv_2}{dt} = 0$$

$$\Rightarrow \frac{dv_2}{dt} + v_2 - v_1 = 0$$

$$\Rightarrow v_1 = v_2 + \frac{dv_2}{dt} \quad \text{—— (2)}$$

3

Substituting (2) in (1) we get

8.45
10.5
11.40
Third year
101 cash
Trend
10.95
9.98
Married
WORN

$$2\frac{d}{dt}\left(v_2+\frac{dv_2}{dt}\right)+3\left(v_2+\frac{dv_2}{dt}\right)-v_2=0$$

$$\Rightarrow 2\frac{dv_2}{dt}+2\frac{d^2v_2}{dt^2}+3v_2+3\frac{dv_2}{dt}-v_2=0$$

$$\Rightarrow \cancel{1}\frac{d^2v_2}{dt^2}+\frac{5}{2}\frac{dv_2}{dt}+\frac{2v_2}{2}=0$$ 3

$$\frac{d^2}{dt^2}v_2+\frac{5}{2}\frac{d}{dt}v_2+v_2=0$$

$2\cancel{\alpha=4}$ | $\cancel{\omega_n^2=2}$

$\Rightarrow \cancel{\alpha=2}$ | $\cancel{\omega_n=\sqrt{2}}$

$\therefore \alpha > \omega_n$ (overdamped) 3

$\boxed{\omega_n^2=1}$

$2\alpha=5/2$

$\boxed{\alpha=5/4}$

$$s=-\alpha\pm\sqrt{\alpha^2-\omega_n^2}$$ $$-\frac{5}{4}\pm\sqrt{\frac{25}{16}-1}$$ 3

$$=-2\pm\sqrt{4-2}$$

$$=-2\pm\sqrt{2}$$

$\boxed{s_1=-\frac{1}{2}, \quad s_2=-2}$

$$=-2+\sqrt{2} \sim -2-\sqrt{2}$$

$$-0.585 \sim -3.414$$

$A_2=-4$

$A_1=16$

8

$v_2=16e^{-t/2}-4e^{-2t}$

$v_1=8e^{-t/2}+4e^{-2t}$

3

$-0.585t \quad -3.414t$

A ... A