LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering

EE240 Circuits I
Quiz 02 - Section 2

Name: _____

Campus ID: _____

Total Marks: 10
Time Duration: 15 minutes

Question 1 (4 marks)

The current entering the positive terminal of the inductor is $i(t) = 3(1 - e^{-t})$ A for $t \geq 0$ and $i(t) = 0$ A for $t < 0$.

(a) [2 marks] Determine the voltage across the inductor. Give an expression.

(b) [1 mark] Determine the power absorbed by the inductor.

(c) [1 mark] Determine the energy absorbed by the inductor in 2 seconds.

Solutions:

(a) $v_L(t) = L\frac{di}{dt} = L\,3e^{-t}$ Volts.

(b) $p(t) = v_L(t)\,i(t) = L\,3e^{-t}\,(1 - e^{-t})$ Watts.

(c) $w(t) = \frac{1}{2}Li(t)^2 = L\,\frac{9}{2}(1 - e^{-t})^2 = 3.3644L$ Joules.

Question 2 (6 marks)

The voltage across the $0.5H$ inductor is given by $v_L(t) = 4\sin(\omega_o t)$.

(a) [2 marks] Evaluate the expression for the current $i_L(t)$ through the inductor.

(b) [2 marks] Plot the current, voltage and power versus time for $0 \leq t \leq 4\pi/\omega_o$. You must appropriately label the plots.

(c) [1 mark] How does the amplitude of the current change with the increase in the frequency ω_o?

(d) [1 mark] How much energy (average power) over one period is stored in an inductor?

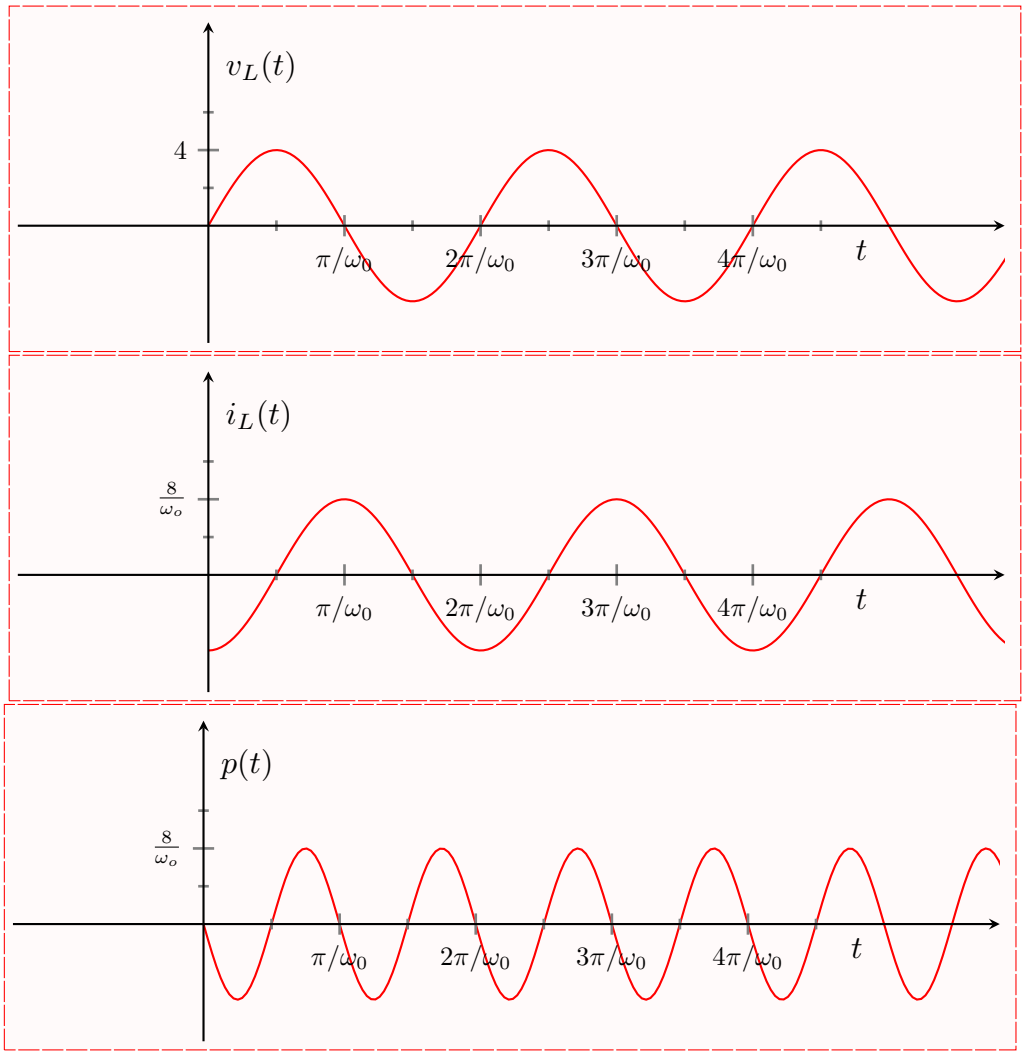
Solutions:

(a) $i_L = \frac{1}{L}\int v_L(t)dt = -\frac{8}{\omega_o}\cos(\omega_o t)$.

(b) See next page

(c) The current decreases as evident in the expression evaluated on part(a).

(d) $p(t) = -\frac{16}{\omega_o}\cos(\omega_o t)\sin(\omega_o t) = -\frac{8}{\omega_o}\sin(2\omega_o t)$. Average over two periods is zero.


$v_L(t)$
4
π/ω_0
$2\pi/\omega_0$
$3\pi/\omega_0$
$4\pi/\omega_0$
t
$i_L(t)$
$\frac{8}{\omega_o}$
π/ω_0
$2\pi/\omega_0$
$3\pi/\omega_0$
$4\pi/\omega_0$
t
$p(t)$
$\frac{8}{\omega_o}$
π/ω_0
$2\pi/\omega_0$
$3\pi/\omega_0$
$4\pi/\omega_0$
t