Department of Electrical Engineering
Assignment
Date: 21/08/2020

Course Details

Course Title:	AC Circuit Analysis	**Module:**	B-tech
Instructor:	RASHID ALIM	**Total Marks:**	30

Name: Azhad niaz **Student ID:** 15493

Q1	(a)	For the circuit shown below, calculate the voltage V, the conductance G, and the power P. 	Ma...

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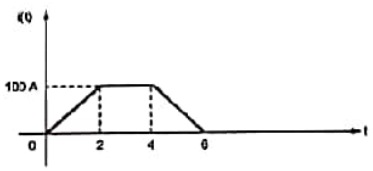
Q1	(a)	For the circuit shown below, calculate the voltage V, the conductance G, and the power P. 	Marks 05
	(b)	A resistor absorbs an instantaneous power of 20 $Cos^2(t)mW$ when connected to a voltage source $V = 10\cos(t)\ v$. Find I and R?	Marks 05
Q2	(a)	The current in a 4H inductor raises at a rate of 4A/s .Find the voltage across the inductor the energy stored in the magnetic field at after 2sec.	Marks 04

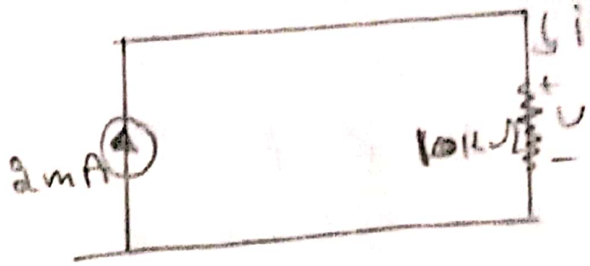
	(b)	A current waveform flowing through an inductor of 1mH is shown in the figure. Obtain and sketch the waveform of voltage across the inductor. 	Marks 06
Q3	(a)	A series RLC circuit containing a resistance of 12Ω, an inductance of 0.15H and a capacitor of 100uF are connected in series across a 100V, 50Hz supply. Calculate the total circuit impedance, the circuits current, power factor and draw the voltage phasor diagram	Marks 07

	Subject	NAME
ID # 15493	AC circuit	Azhar Omar

Ans (1)

(a)

Solution:-



Ist we have to find

$V = ?$

$V = IR$

$V = 2 \times 10 = 20\,V$

Now Conductance is

$$G = \frac{1}{R} = \frac{2}{10 \times 10^3}$$

$G = 100\,\mu S$.

Now power is

$P = Vi = 20 \times 2$

$P = 40\,mW$

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Q1 (B)

Solution:-

Given a resistor absorbs an instantaneous power of

$20\cos^2 t$ mW

$P = 20\cos^2 t$ mW

The given voltage source is

$V = 10\cos t$ V

We know that instantaneous

$P = Vi$

$i = \frac{P}{V}$

$i = \frac{20\cos^2 t \times 10^{-3}}{10\cos t}$

$i = 2\cos t \times 10^{-3}$

$\therefore$ ~~$i = 2\cos t$ mA~~

$\therefore$ $i = 2\cos t$ mA

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Q2 (a)

Solution:-

$$V = L\frac{di}{dt}$$

So putting values

$$= 4 \times 4 = 8V$$

Q2 (B) Solution:-

From the given waveform

For $0 < t < 2$, $i(t)$ is a straight line of slope $= (100/2) = 50$

therefore, $i(t) = 50t$ and $\frac{di(t)}{dt} = 0$

For $2 < t < 4$, $i(t) = 100$ and

$$\frac{di(t)}{dt} = 0$$

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Q2(b)

For $4<t<6$, $i(t)$ is a straight line of slope $= -(100/2) = -50$

therefore, $i(t) = -50t$ and

$$\frac{di(t)}{dt} = -50$$

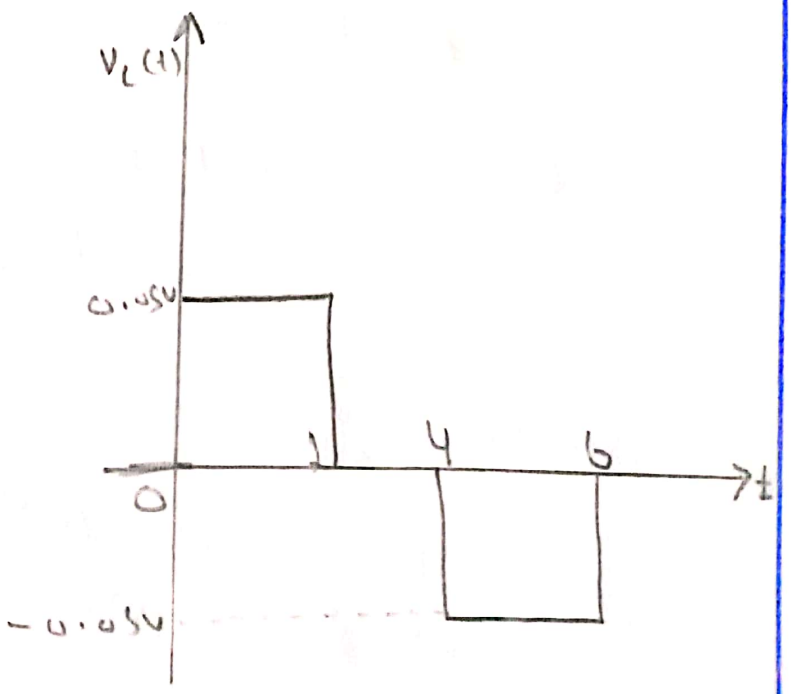
Now $v_L(t) = L\frac{di(t)}{dt}$

$= 1\times10^{-3}\times50 = 0.05V \quad 0<t<2$

$= 1\times10\times10^{-3}\times0 = 0V \quad 2<t<4$

$= 1\times10^{-3}(-50) = -0.05V \quad 4<t<6$

The voltage is shown in below



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Q3:- (A)

Solution:-

Inductive Reactance, X_L.

$X_L = 2\pi fL = 2\pi \times 50 \times 0.15$

$= 47.13\Omega$

Capacitive Reactance, X_C.

$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 50 \times 100 \times 10^{-6}}$

$= 31.83\Omega$

Circuit Impedance Z

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$Z = \sqrt{19^2 + (47.13 - 31.83)^2}$

$Z = \sqrt{144 + 234} = 19.4\Omega$

Circuit current, I.

$I = \frac{V_s}{Z} = \frac{100}{19.4} = 5.14$ Amps

Voltage across the series RLC circuit V_R. V_L. V_C

$V_R = I \times R = 5.14 \times 12 = 61.7$ volts

$V_L = I \times X_L = 5.14 \times 47.13 = 242.2$ V

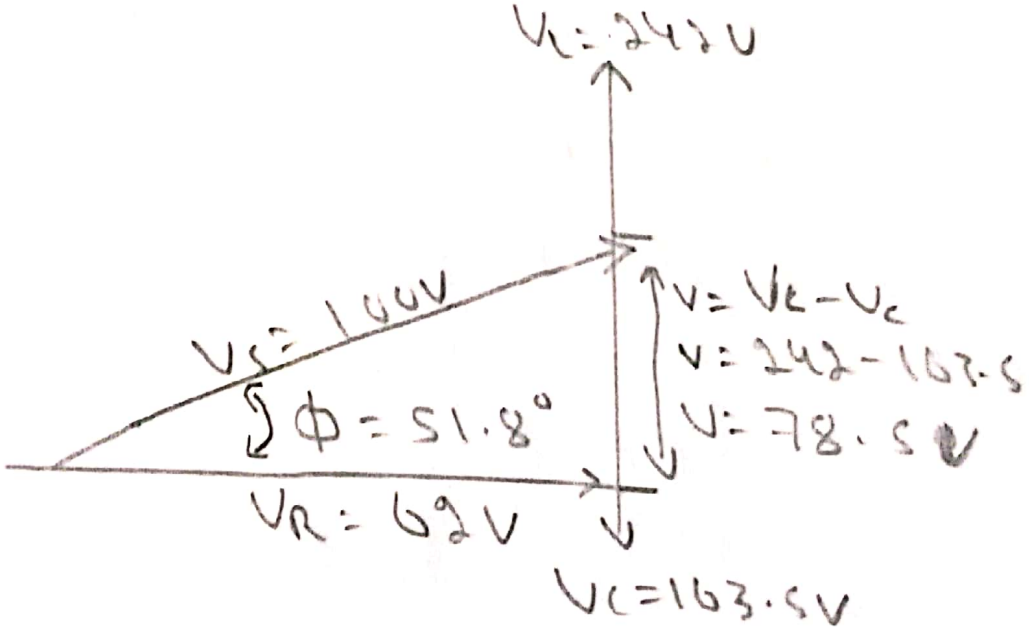
$V_C = I \times X_C = 5.14 \times 31.8 = 163.5$ volts

Circuits Power factor and Phase Angle. Φ.

$$\cos\phi = \frac{R}{Z} = \frac{12}{99.4} = 0.619$$

$\therefore \cos^{-1} 0.619 = 51.8°$ lagging

Phaser Diagram.



Q3(b)

Ans: **Over Damped:** The O airplane takes off very slowly and hence has a very high value of **Rise Time:** as compared to other two systems. Rise time being defined as time taken to reach the level of center of the blue denoted by dotted line in the figure. Also due to some navigational anomalies it never reaches its destination and stays below the required height

Critically Damped: The C plane is better than the O and almost (asymptotically) reaches the target and that too at a better speed and less time than O.

Under Damped: The U plane pilot is very enthusiastic and its excitement goes at very high speed hence goes pass the target and that too is very less time (Rise time) as compared to other two planes Releasing his mistake it again come back but again enthusiasm kicks in and the again passes the destination this time

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in oppositedirection this time in opposite Direction. This process continues until a specific time until he is settled. we call this time as the **setting Time** and after this time he finally reaches his destination. So in our little story the three paths takes by the planes represents the 3 time responses of second order system. when subjected to until step response. main difference lies in their Rise time and setting time and final steady state value achieved which dicated various design parameters in control system.

mathematical Explanation:

Any general second order equation can be represented as:

$$ms^2 + bs + k = 0.$$

with general solution as:

$$s1 = -\frac{b}{2m} + \frac{\sqrt{b^2-4mk}}{2m}$$

$$s2 = -\frac{b}{2m} - \frac{\sqrt{b^2-4mk}}{2m}$$