Tutorial 5 for CAD
Sample Questions and Exercises

2020-21

Exercise 1

- Given a sinusoidal signal

$$v = 5\cos(2\pi 500t + 120^o)\text{V}$$

a. find the frequency in hertz.
b. find the period in seconds.
c. find the frequency in radians/s.
d. plot the instantaneous frequency as a function of time.

Exercise 2

- Represent v(t) = $100\cos(2\pi 60t + 120^o)$ V by its phasor and plot the phasor.

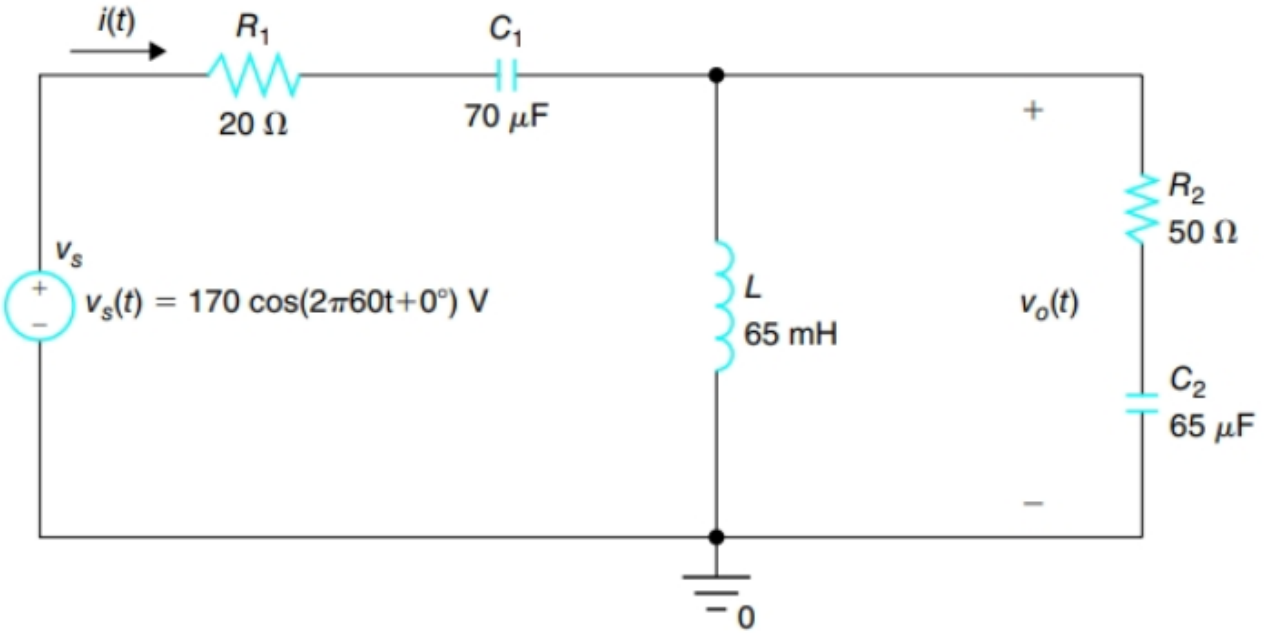
Exercise 3

- Convert the following complex numbers in polar coordinates to Cartesian coordinates (rectangular coordinates)

a. $\mathbf{I} = 5\angle 30^\circ \text{ A}$
b. $\mathbf{I} = 6\angle 120^\circ \text{ A}$
c. $\mathbf{I} = 10\angle -120^\circ \text{ A}$
d. $\mathbf{I} = 20\angle -60^\circ \text{ A}$

Exercise 4

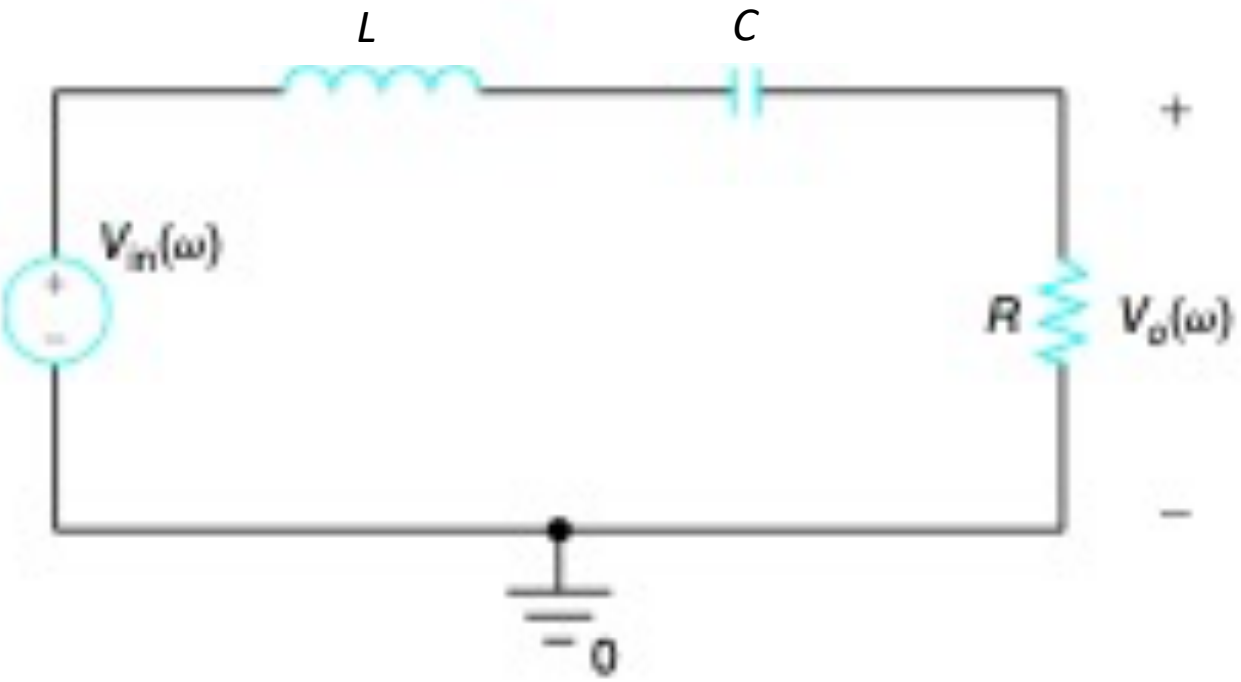
- For the circuit shown below



a. draw the phasor-transformed circuit.
b. find the phasors for $i(t)$ and $v_o(t)$.
c. find the time domain waveforms $i(t)$ and $v_o(t)$.

Exercise 5

- Design a BPF of the type show in figure below:



(Questions are in the next page)

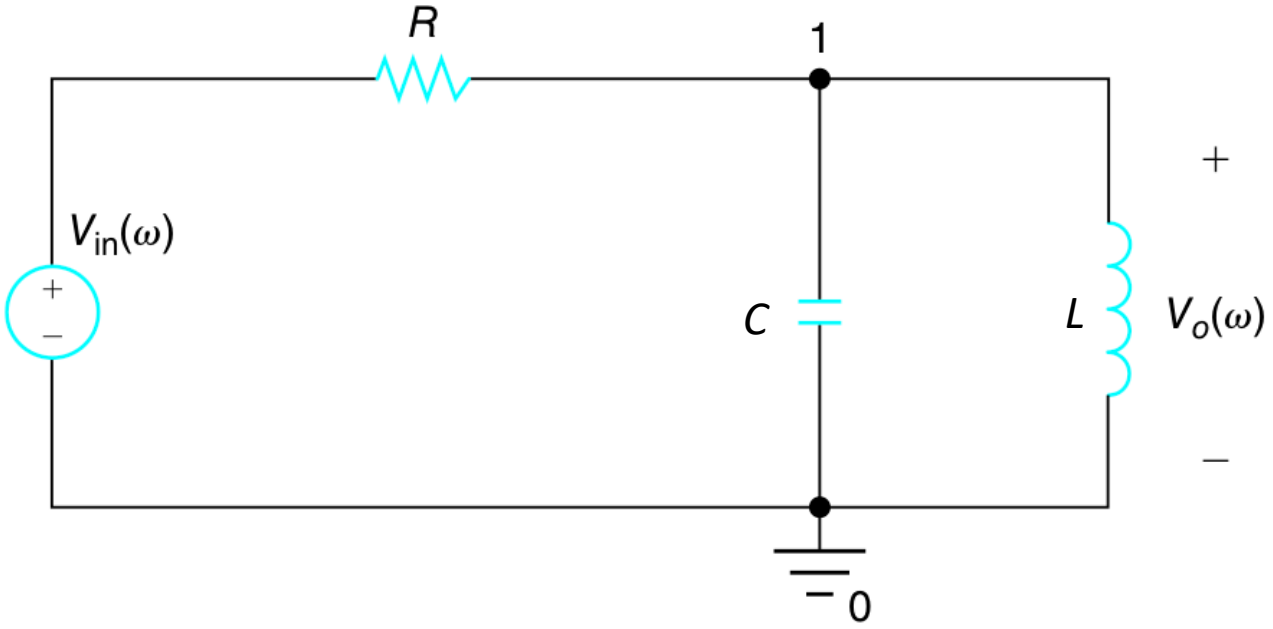
Exercise 5

Taking a lower cutoff frequency of 20.1 kHz, an upper cutoff frequency of 20.3 kHz and R=20 kΩ, calculate:

a. 3dB Bandwidth (ω_{3dB})
b. Resonant frequency (ω_o)
c. Value of inductor (L)
d. Value of capacitor (C)
e. Quality factor (Q)

Exercise 6

- Let R = 5kΩ, L=20mH, and C=0.5μF for the circuit below:



(Questions are in the next page)

Exercise 6

Find:

a. The transfer function (H_ω)
b. Resonant frequency (ω_o)
c. Lower cut-off frequency (ω_1)
d. Upper cut-off frequency (ω_2)
e. 3dB bandwidth (ω_{3dB})
f. Quality factor (Q)
g. Plot the magnitude and phase response on a linear scale
h. Determine the type of the filter.