CENTER OF NANOELECTRONICS & DEVICES

Handwritten Assignments 3

Question 1:

A resistor, denoted as R_l, is added in series with the inductor as shown in the figure on the left.

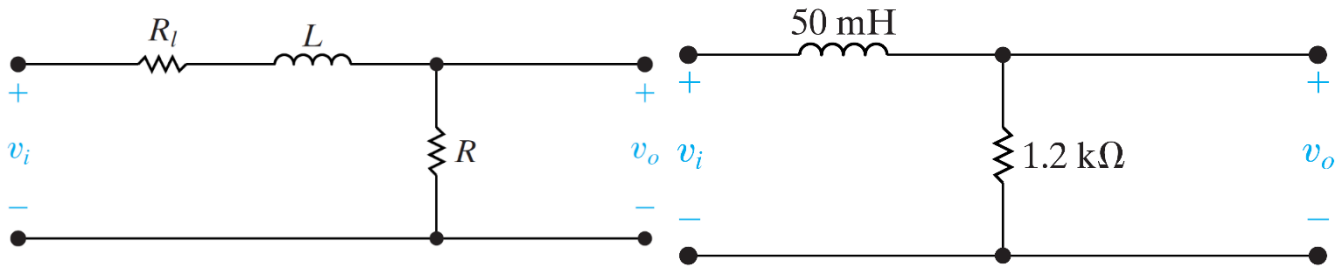
a) Derive the expression for H(s) where H(s)= V_0 /V_i

b) At what frequency will the magnitude of H(jω) be maximum?

c) What is the maximum value of the magnitude of H(jω)?

d) At what frequency will the magnitude of H(jω) equal its maximum value divided by$\sqrt{2}$?

e) Assume a resistance of 300 Ω is added in series with the 50 mH inductor in the circuit in the figure on the right. Find ω_c , H(j0), H(jω_c), H(j0.2ω_c), and H(j5ω_c).



Question 2:

A bandpass filter has a center, or resonant, frequency of 50 krad/s and a quality factor of 4. Find the band- width, the upper cutoff frequency, and the lower cut- off frequency. Express all answers in kilohertz.

Question 3:

A block diagram of a system consisting of a sinu- soidal voltage source, an RLC series bandpass fil- ter, and a load is shown in Fig. P14.32. The internal impedance of the sinusoidal source is 80+ jo, and the impedance of the load is 480+ jo n. The RLC series bandpass filter has a 20 nF capacitor, a center frequency of 50 krad/s, and a quality factor of 6.25.

a) Draw a circuit diagram of the system.

b) Specify the numerical values of L and R for the filter section of the system.

c) What is the quality factor of the interconnected system?

d) What is the bandwidth (in hertz) of the inter- connected system?