HOMEWORK -2
EE101

Deadline: 04-09-2015,5:00 PM.

1). Two circuits, the impedance of which are given by $Z_1 = 10 + j\,15\ \Omega$ and $Z_2 = 6 - j8\ \Omega$ are connected in parallel. If the total current supplied is 15 A, what is the power taken by each branch? Find also the power factor of individual circuits and of combination.

2). Construct the Bode magnitude and phase plots for

$$\mathbf{H(s) = 40(s+1)/(s+2)(s+10)}$$

3).Construct the Bode plots for

$$\mathbf{G(s) = s/(s+2)^2 + (s+1)}$$

4). A sinusoidal voltage V (t) = (200V)sinωt is applied to a series RLC circuit with L =10.0 mH , C =100 nF and R = 20.0 Ω . Find the following quantities:

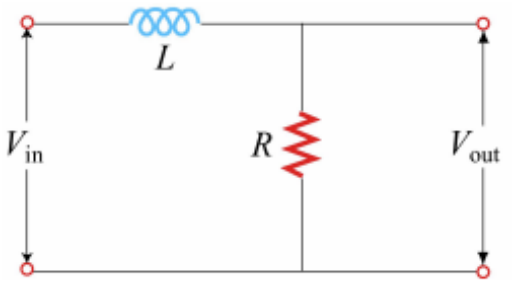
(a) the resonant frequency,

(b) the amplitude of the current at resonance,

(c) the quality factor Q of the circuit,

(d) the amplitude of the voltage across the inductor at the resonant frequency.

5). The circuit shown in Figure represents a RL filter.



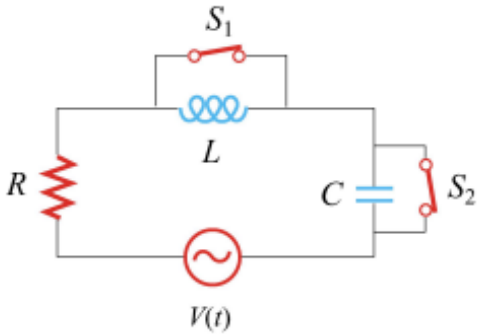
Let the inductance be L = 400 mH, and the input voltage Vin = (20.0V)sin(ωt) , where ω = 200 rad/s.

(a) What is the value of R such that the output voltage lags behind the input voltage by 30.0° ?

(b) Find the ratio of the amplitude of the output and the input voltages. What type of filter is this circuit, high-pass or low-pass?

(c) If the positions of the resistor and the inductor were switched, would the circuit be a high-pass or a low-pass filter?

6). Consider the circuit shown in Figure. The sinusoidal voltage source is V (t) = V0 sin(ωt). If both switches S1 and S2 are closed initially, find the following quantities, ignoring the transient effect and assuming that R , L , V0 , and ω are known.



(a) The current I(t) as a function of time.

(b) The average power delivered to the circuit

(c) The current as a function of time a long time after only 1 S is opened

(d) The capacitance C if both 1 S and 2 S are opened for a long time, with the current and voltage in phase.

(e) The impedance of the circuit when both 1 S and 2 S are opened.

(f) The maximum energy stored in the capacitor during oscillations.

(g) The maximum energy stored in the inductor during oscillations.

(h) The phase difference between the current and the voltage if the frequency of V (t) is doubled.

(i) The frequency at which the inductive reactance XL is equal to half the capacitive reactance XC .