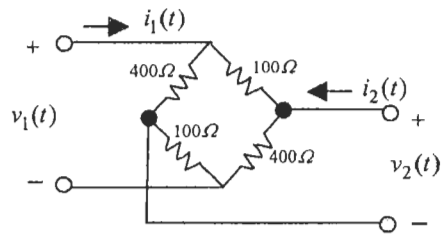
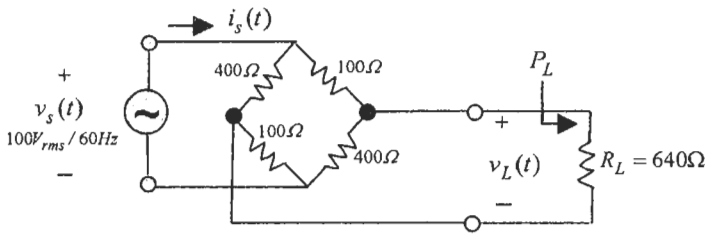
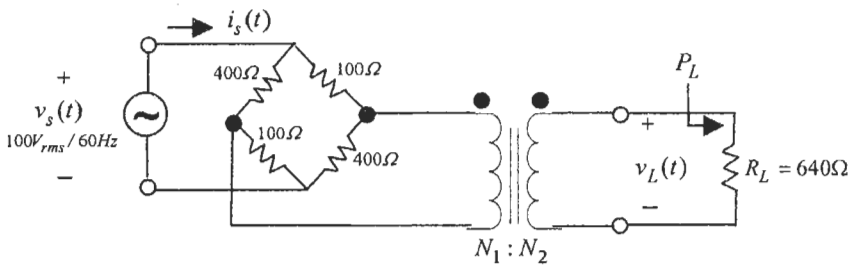
1. (1) Find the z parameters of the given two-port network. （7%）



(2) Now the above network is connected as below to deliver power from source to load. Find the load real power P_L . （7%）



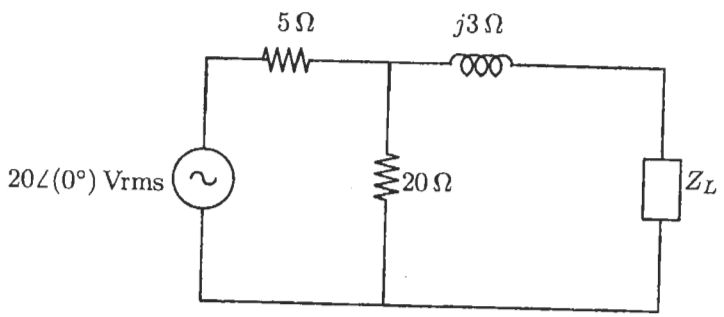
(3) If the maximum power transfer is desired, find the transformer turn ratio $N_1 : N_2$ and this maximum load power. （6%）



2. (a) For the given circuit, please determine the impedance Z_L which results in maximum average power transferred to Z_L.

(b) Find the real power, reactive power and complex power associated with Z_L.

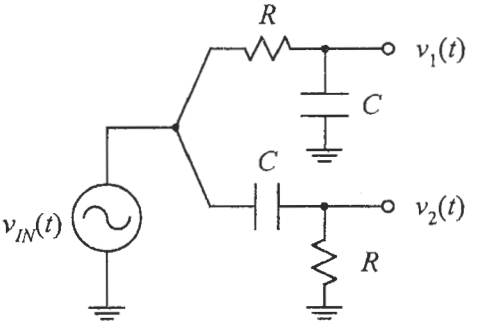
（10%）



3. Assume in the following circuit, the resistance of R is equal to 2 kΩ and the capacitance of C is equal to 0.5 nF.

(a). If $v_{IN}(t)$ is an unit step function, i.e., $v_{IN}(t) = 0$ V when $t < 0$ and $v_{IN}(t) = 1$ V when $t \geq 0$, please calculate $v_1(t)$ and $v_2(t)$. (6%)

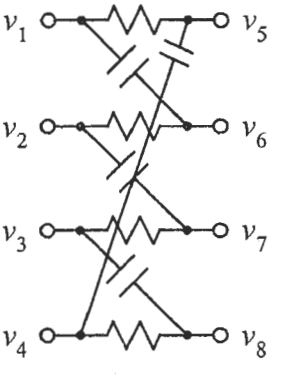
(b). When $v_{IN}(t) = \sin\omega t$, $v_1(t)$ and $v_2(t)$ can be expressed as $A_1 \times \sin(\omega t + \theta_1)$ and $A_2 \times \sin(\omega t + \theta_2)$, respectively. Please find the value ω so that $A_1 = A_2$. Also please calculate the phase difference $(\theta_1 - \theta_2)$ in this condition. (7%)



4. There is a multi-input/multi-output RC network shown in the following figure. All the resistor values are equal to 50 kΩ and all the capacitor values are equal to 20 nF. Its inputs are v_1, v_2 , v_3, and v_4. Its outputs are v_5, v_6 , v_7, and v_8.

(a). If $v_1(t) = \sin(1000\times t)$, $v_2(t) = \cos(1000\times t)$, $v_3(t) = -\sin(1000\times t)$, $v_4(t) = -\cos(1000\times t)$, please find v_5, v_6 , v_7, and v_8. (6%)

(b). If $v_1(t) = \sin(1000\times t)$, $v_2(t) = -\cos(1000\times t)$, $v_3(t) = -\sin(1000\times t)$, $v_4(t) = \cos(1000\times t)$, please find v_5, v_6 , v_7, and v_8. (6%)



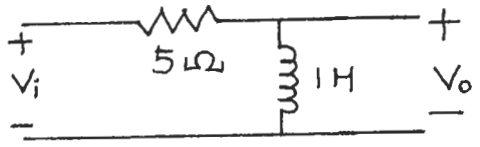
5. (a) In a coupled inductor, why is the coupling coefficient k often less than 1.0?

(b) For a low-pass filter $\frac{p_1}{s+p_1}(p_1 > 0)$, why is p_1 often referred to as the 3-db frequency?

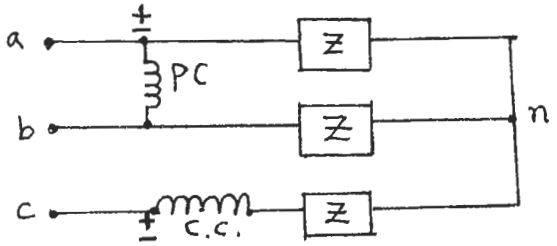
(c) Can you find the phasor representation of $v(t) = e^{-0.01t}cos(100t), (0 < t < 1.0\,\text{sec})$ (Yes/No)? Explain your answer. (10%)

6. (a) Find the transfer function of the following circuit where the input and the output are denoted as Vi and Vo respectively. (7%)

(b) Also find the impulse response of this circuit. (8%)



7. In the following balanced positive phase sequence three-phase circuit, the three -phase load is known to be 30kW + j 40kVars. If an ideal wattmeter is connected as shown in the circuit where cc and pc denotes the current coil and the potential coil respectively, what is the wattmeter reading? (10%)



8. Assume that the following periodic voltage is applied to a one ohm resistor.

$$V(t) = 30 + 20\cos 50t + 10\sin 100t - 5\cos 150t \quad \text{volts}$$

Calculate the average power delivered to this resistor. (10%)