Question 1  [15 points]

Figure 1 shows a balanced three-phase circuit with positive phase sequence. Let $R_w = 2 \, \Omega$ and $V_{BC} = 120 \, 60^0 \, V$ rms. The source is supplying a total complex power of 5 KVA at $pf. = 0.8$ lagging. Find:

1. The total power lost in the line resistor $R_w$.
2. The line current $I_{aA}$.
3. The load impedance $Z_p$.
4. The voltage $V_{an}$.

Question 2  [15 points]

The switch in Fig. 2 has been closed for a long time, at $t = 0$ it is opened.

(a) Find $V_C(t)$ for $t \geq 0$.

(b) Calculate $i_A$ at $t = 100 \, \mu$sec.

Question 3  [15 points]

The switch in Fig. 3 has been closed for a long time, at $t = 0$ it is opened. Find $V_C(t)$ for $t \geq 0$.

Question 4  [20 points]

(a) The physical construction of two pairs of magnetically coupled coils is shown in Fig. 4. Show a possible locations for the dot markings on each pair of coils.

(b) Find the current $I_x$ for the circuit shown in Fig. 5.

Question 5  [15 points]

For the two-port circuit shown in Fig. 6:

1. Find the $Z$-parameters
2. Find $Z_{input} = V_1 / I_1$ if there is no load.
3. Is the circuit reciprocal?

Question 6  [20 points]

(a) Consider the circuit shown in Fig. 7:

1. Derive an expression for the transfer function $H(s) = V_o(s) / V_i(s)$
2. What type of filter does this circuit represent?
3. At what frequency will the magnitude of $H(j\omega)$ be maximum?
4. What is the maximum value of the magnitude of $H(j\omega)$?
5. What is the cutoff frequency $\omega_c$ (use the definition of the cutoff frequency to derive it)?
6. Sketch the amplitude Bode plot of $H(j\omega)$.