1. Explain the following terms: (5% each, total 20%)
   (a) transfer function (b) spiraling phasor (c) resonance conditions (d) impulse response

2. For the circuit shown in Fig. P2,
   (a) write two node voltage equations for solving v_1 and v_2. (6%)
   (b) draw the dual circuit for Fig. P2. (8%)
   (c) write two mesh current equations for solving the new circuit in (b). (6%)

3. Two coils shown in Fig. P3 have self inductances, L_1 and L_2, and mutual inductance M. Assume the circuit is under sinusoidal steady state. Keep the same terminal voltage and current conditions, derive:
   (a) the T-equivalent circuit and the π-equivalent circuit of Fig. P3, (12%)
   (b) If an ideal transformer with turn ratio of 1:a is inserted into the equivalent circuits of (a), draw four possible connections. (8%)

4. The circuit shown in Fig. P4 is the equivalent circuit of a small-signal amplifier. Assume the capacitors have no initial conditions. Find $v_1(t)$ and $v_2(t)$ if the conditions of the circuit parameters are:
   (a) $R_1C_1 \neq R_2C_2$ (10%)
   (b) $R_1C_1 = R_2C_2$ (10%)

5. Three-phase, balanced, Δ-connected, negative phase sequence, 480-V, 60-Hz source is connected to a Y-connected unbalanced load: $Z_A = 10\angle 0°\ \Omega$, $Z_B = 5\angle -30°\ \Omega$, $Z_C = 5\angle 30°\ \Omega$. Take V_{AB} as 0° reference and use KVL method to find:
   (a) the readings of two watt meters connected at lines A and B. (8%)
   (b) total complex power, apparent power, and reactive power of load. (12%)

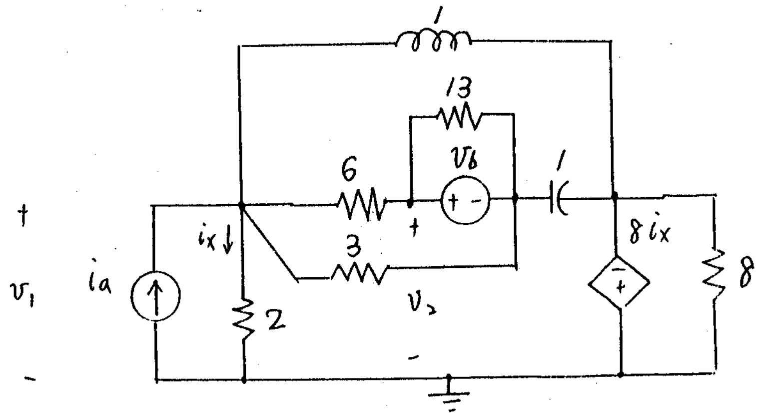

Fig. P2 (V, A, Ω, H, F)

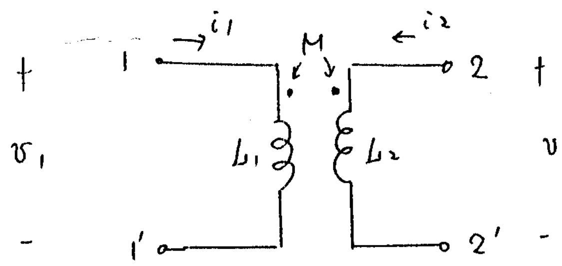

Fig. P3 (V, A, H)

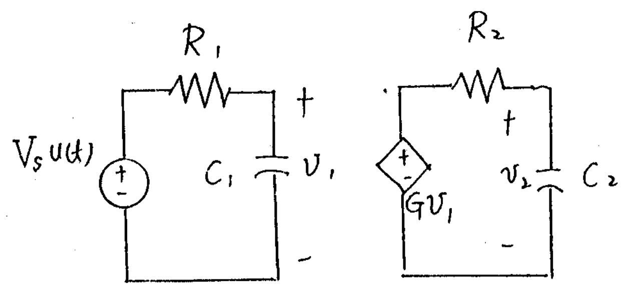

Fig. P4 (V, Ω, F)