1. Apply mesh analysis to find i_1, i_2, and the power supplied by the current source of 2 A as shown in Fig. 1. (20%)
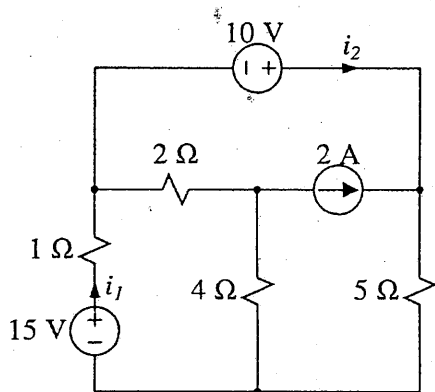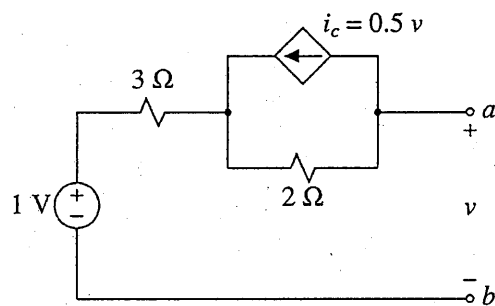

Fig. 1

Fig. 2

2. Consider the circuit shown in Fig. 2.

   (a) Find the Thévenin equivalent circuit. (15%)

   (b) Find the value of a resistor connected across a, b to have the maximum power transferred and calculate the maximum power. (5%)

3. Consider the circuit shown in Fig. 3, where

$$i_s(t) = \begin{cases} -1\ A & t < 0 \\ 1\ A & t > 0 \end{cases}.$$

   (a) Find $v_C(0^+)$ and $v_C'(0^+)$. (5%)

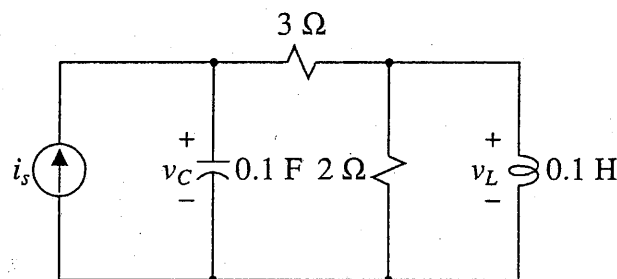   (b) Use laplace transform to find $v_L(t)$ for $t > 0$. (15%)

Fig. 3

4. The transformer circuit in Fig. 4 operates under steady-state condition. Find $i_1(t)$, $i_2(t)$, and $v_{out}(t)$ given that $v_s(t) = 5\sin(1000t)$ V. (20%)
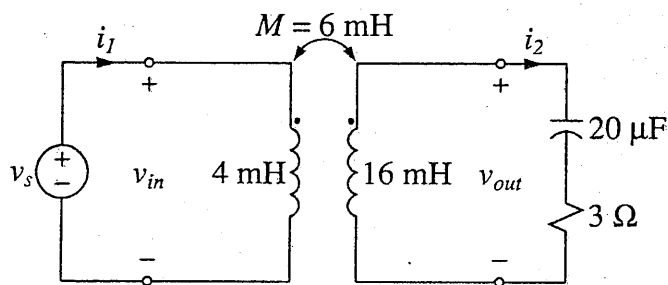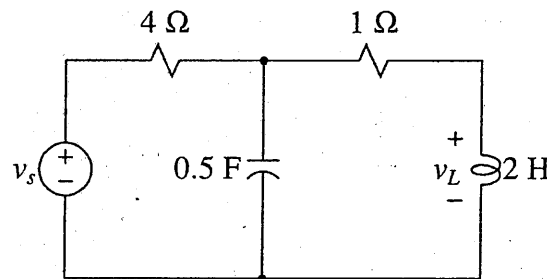

Fig. 4

Fig. 5

5. For a circuit shown in Fig. 5,

   (a) obtain the transfer function $H(s) = \dfrac{V_L}{V_s}$; (10%)

   (b) find the forced response $v_L(t)$ when $v_s(t) = 2e^{-t}\cos(4t)$. (10%)