Figure P12.6

7. The linear time-invariant circuit of Fig. P12.7a, having a digraph shown in Fig. P12.7b, is in the sinusoidal steady state. From the digraph a tree is picked as shown in Fig. P12.7c.

(a) Write the fundamental cut-set matrix $\mathbf{Q}$.

(b) Calculate the cut-set admittance matrix $\mathbf{Y}_q$

(c) Write the cut-set equations in the frequency domain in terms of the cut-set voltage and the current source:
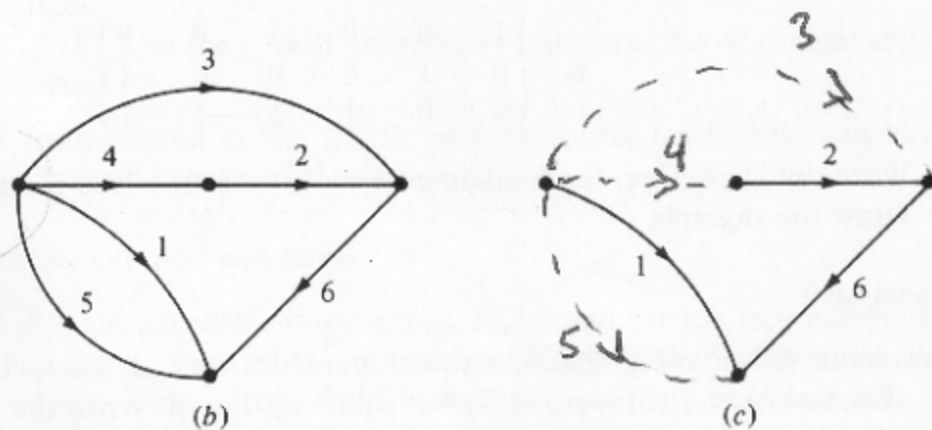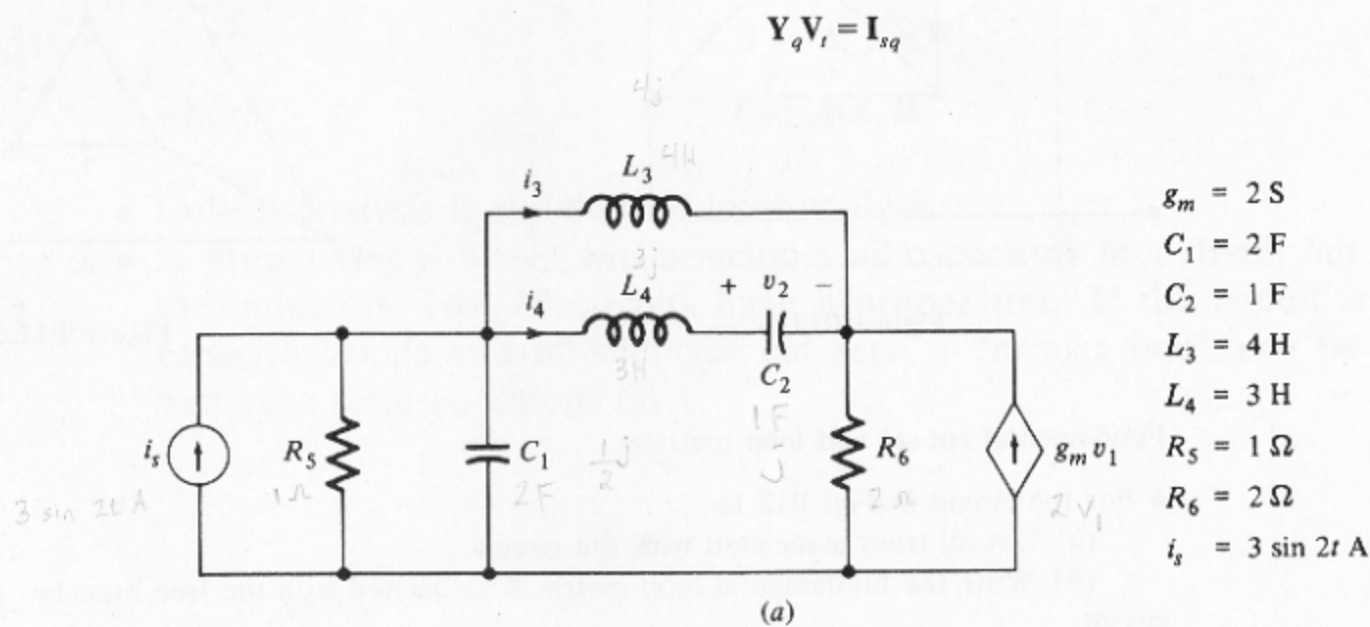
$$\mathbf{Y}_q\mathbf{V}_t = \mathbf{I}_{sq}$$

$g_m = 2\,\text{S}$
$C_1 = 2\,\text{F}$
$C_2 = 1\,\text{F}$
$L_3 = 4\,\text{H}$
$L_4 = 3\,\text{H}$
$R_5 = 1\,\Omega$
$R_6 = 2\,\Omega$
$i_s = 3 \sin 2t\,\text{A}$

(a)

(b)　　　　(c)

Figure P12.7